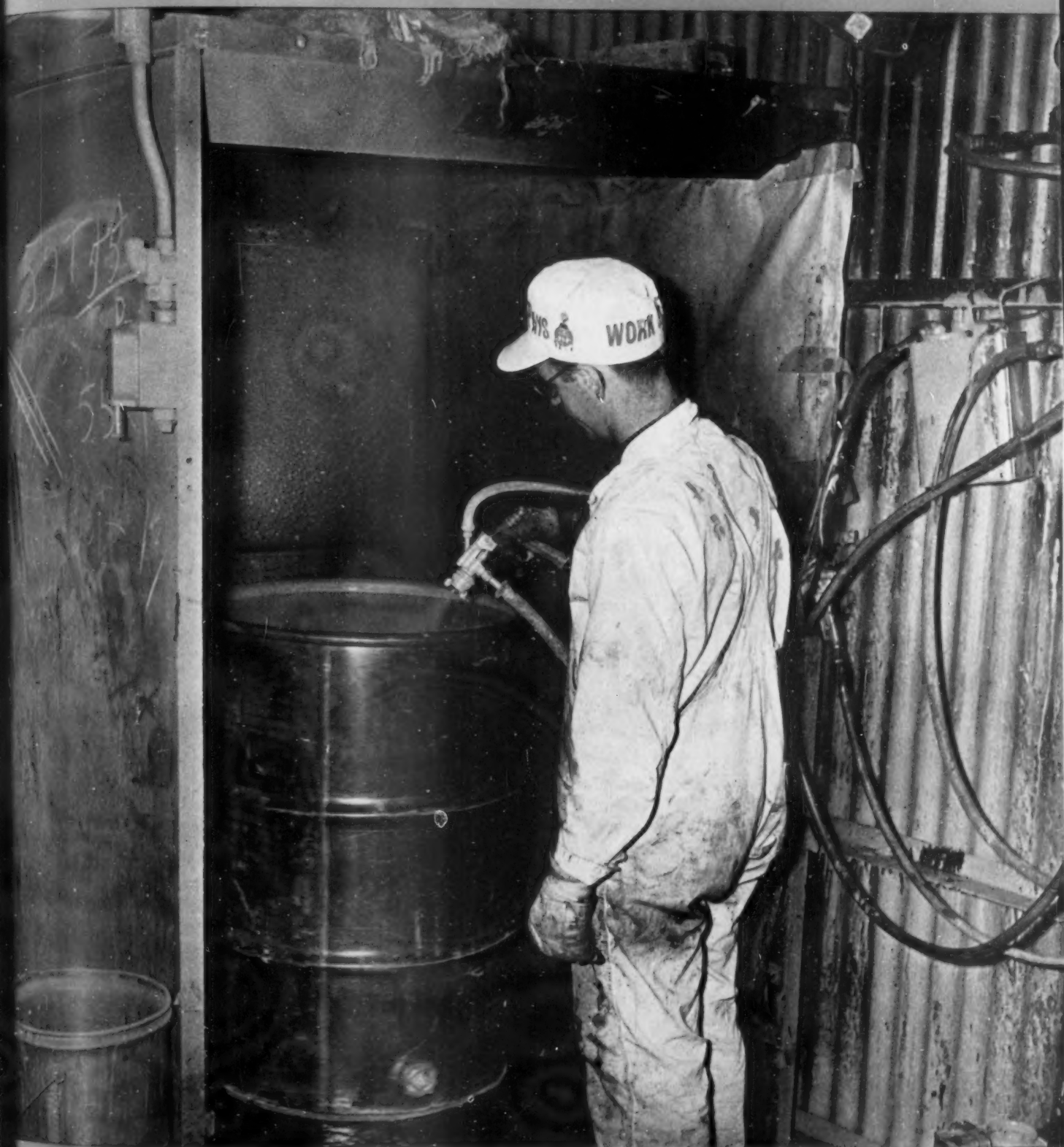


OCTOBER, 1942

ORGANIC FINISHING

SECTION OF METAL FINISHING



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ORGANIC FINISHING

SECTION OF METAL FINISHING

OCTOBER, 1942

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Photograph On Cover

The picture on the cover shows an operator in the Chicago plant of the Sherwin-Williams Co. in the act of spraying a steel drum for re-use. This is important in view of the restrictions placed upon the use of steel drums by the War Production Board.

Fighting Fires in Closed Spaces

The Safety Research Institute has recently issued the following advice for improving fire defenses.

This year, the fire brigades of many businesses and industries might profitably be given special instruction in an important, but often overlooked problem—that of fighting fires in confined spaces, such as basements, cellars, pits, manholes, vaults, and other small compartments.

The important feature of this problem is that it involves life-hazards that exist to a far less degree with fires in places where there is ample ventilation.

These hazards originate in the fire itself, and go beyond the heat and flame. Every fire, especially when burning where the ventilation is poor, generates large volumes of the deadly carbon monoxide and, frequently, other gases, such as hydrogen sulphide and hydrogen cyanide, which are even more poisonous. In consequence, it is always dangerous to breathe smoke and fire gases, and special care must be taken to avoid this danger when the fire is in a confined space.

In fighting fire in a confined space, therefore, the following rules should always be observed:

1. Fight the fire from outside the space wherever possible, standing where there is fresh air and discharging the extinguishing agent on the fire through a doorway or other opening.
2. After the fire is out, do not enter the space without respiratory protection until it has been thoroughly ventilated. Some spaces, such as manholes, may have to be ventilated mechanically before they are safe to enter.
3. If a small, unventilated space must be entered when a fire is burning in it, or immediately after the fire has been extinguished, gas masks must be worn. The "all-service" type of mask, which protects against carbon monoxide as well as other fire gases, may be worn when the atmosphere of the space is known to contain enough air to support life; but, if there is reason to believe that the atmosphere is deficient in oxygen, some type of oxygen breathing equipment must be used.

NEWS FROM WASHINGTON—

The use of new or second hand steel shipping drums for packing approximately 200 food, chemical and petroleum products after 60 days from Sept. 14 has been prohibited by the War Production Board in Limitation Order L-197.

Effective Sept. 14, 1942, the order also prohibits the packing of any product on an additional list of approximately 35 items in a new or used drum manufactured, purchased, or delivered after Sept. 14. This provision does not prohibit the packing of a product on the second list in drums now owned by the packer.

The order forbids the use by any person of new or used drums for packing products which he has not packed in drums prior to the issuance of today's order.

Officials of the Containers Branch said that the order is expected to conserve approximately 100,000 tons of steel annually, and release thousands of drums for essential purposes. Most products barred from the use of steel drums are expected to be shifted to tight cooperage (barrels) and in some cases, to fibre containers and glass containers.

Among the products which may not be packed in steel drums after the 60-day period are flour, lard, fruits or vegetables in brine, paints, colors, shellac, crude oil, petrolatum, and many chemicals.

Among products which cannot be packed in steel drums after Sept. 14, if the drums are not owned then by the packer, are asphalt, floor wax, animal, fish, and vegetable oils, turpentine, liquefied silicate of soda, and printing inks.

In order to distinguish between drums owned by the packer, and drums made or sold after Oct. 1, the order requires that all drums manufactured, purchased, or delivered after Oct. 1 be plainly marked on the bottom plate with a letter "X".

The restrictions of the order do not apply to persons having less than 5 drums in use for all purposes, or to drums used for the sale and delivery of commodities to the Army and Navy and certain other designated Government agencies.

Phthalic anhydride was placed under complete allocation and use control by issuance of General Preference Order M-214 on October 1st, 1942. This chemical is widely used for the making of synthetic coatings when combined with such materials as glycerine.

This year's production is approximately adequate for current demands, but 1943 demands are expected to be somewhat in excess of this year's demand. Until new facilities start producing, allocation will prevent critical shortages for essential needs.

The order forbids any person to deliver, accept delivery of or use phthalic anhydride without specific authorization of WPB. Quantities of 700 pounds or less per month are exempt if the receiver has not received an allocation in that month.

The standard chemical allocation forms, PD-600 and PD-601 are to be used in requesting allocation and reporting to WPB. Specific directions for filling in these forms are included in the order.

Glycols were placed under complete allocation on October 1st, 1942 by issuance of General Preference Order M-215.

Glycols, meaning ethylene glycol, propylene glycol, diethylene glycol, and triethylene glycol, are widely used for military engine coolants and anti-freezes; as a component in dynamite manufacture; as a fluid for hydraulic systems in aircraft and ships; in cutting oils and other industrial products; as tobacco moistening

agents; in food, drug, and a number of miscellaneous products. Glycols can be substituted for glycerine, now critically short, and it is the intention of this order to encourage this substitution wherever possible.

Increased supplies of the glycols are dependent upon raw materials, production facilities being ample. Chlorine provides the principal material problem at present in their manufacture. Increase or decrease in output of individual glycols can be varied by changing the raw materials used. The order provides that manufacturers must follow the directions of WPB as to what glycols they may manufacture.

The text of the order forbids any person to deliver, accept delivery of, or use glycols unless he has specific authorization by WPB to do so. Deliveries of 55 gallons or less are excepted, if they are not to be used for anti-freeze purposes.

Anti-freeze, which is now manufactured containing glycols, is not covered by the order, though nothing in M-215 is to be construed to permit manufacture of anti-freeze in violation of the anti-freeze limitation order, L-51.

Dichlorethyl ether was placed under complete allocation on September 5th by issuance of General Preference Order M-226.

The order provides that no person may deliver, accept delivery of, or use dichlorethyl ether without specific authorization of the Director General. No exception is made for small quantities.

Dichlorethyl ether is used principally as a "selective solvent" for purifying lubrication oils and butadiene. Military needs for oils so treated are great, and the synthetic rubber program will require large, but as yet not precisely determined, amounts of dichlorethyl ether for purification of butadiene. Allocations and use control are deemed necessary to prevent diversion of present supply to non-essential uses.

Initial requirements of dichlorethyl ether in new butadiene plants are substantially greater than needs, after the plants are in operation so it is imperative that stocks be accumulated to enable new plants now under construction to begin operating immediately on completion.

Lowered maximum prices for normal butyl alcohol and for acetone produced by both fermentation and synthesis went into effect on October 3rd, 1942.

Maximum Price Regulation No. 37 sets a maximum price of 12½ cents per pound for the butyl alcohol produced by fermentation, while Maximum Price Regulation No. 36 establishes a price of 8½ cents a pound for fermentation acetone.

Under Revised Price Schedules Nos. 36 and 37, which had governed these products up to the present, the maximum price for both fermentation butyl alcohol and acetone was 15.8 cents a pound.

Castor oil was placed under complete allocation control Sept. 25 by the Director General for Operations in order M-235.

Regular monthly allocation, to be sought on Form PD-600, will begin November 1. Application for use, consumption or processing in October may be made at any time, but thereafter applications must be received by the 15th of the month preceding the month in which delivery is sought.

Exceptions are made for users of 35 pounds or less in any month, for pressing, bleaching, or alkali refining any quantity, or for medicinal purposes.

A Modern Infra-Red Baking System

By CHARLES F. MILLER

Engineer, Gifford-Wood Co.,
Hudson, N. Y.

E. J. McALEER & CO., Inc., Philadelphia, manufacturer of metal cabinets, stampings and metal fabricated products, has recently installed a modern infra-red baking and drying system complete with conveyors designed especially to handle this company's products.

Old Finishing Department

Before installation of the new equipment, the paint department was located on the fourth and fifth floors of the company's building, occupying 10,000 square feet of floor space.

On the fourth floor, they had three sprayers, three helpers and an oven man handling the larger cabinets, up to 20" x 30" x 69".

On fifth floor, they had three sprayers, three helpers, an oven man and an extra helper for carrying cabinets. The smaller cabinets, mainly 12" x 18" x 66", were handled on this floor.

Each floor was equipped with four double gas-fired tubular ovens 10' wide x 7'6" high x 9' deep. This oven size was sufficient for sixteen smaller cabinets or eight large cabinets at a time in each oven.

In order to bring the ovens up to working temperature each morning, it was necessary that they be lit thirty minutes before charging. Using a urea-formaldehyde type of finish, the baking time in convection ovens was forty-five minutes.

Cabinets were placed on trucks after spraying and the loaded truck was pushed into the oven. After removal from the oven, loaded trucks were allowed to stand twenty minutes for cooling, then cabinets were removed from trucks and stood in a row for inspection and touch-up before wrapping. The wrapped cabinets were then placed back on trucks and run into a freight elevator for distribution to shipping platform or warehouse as required.

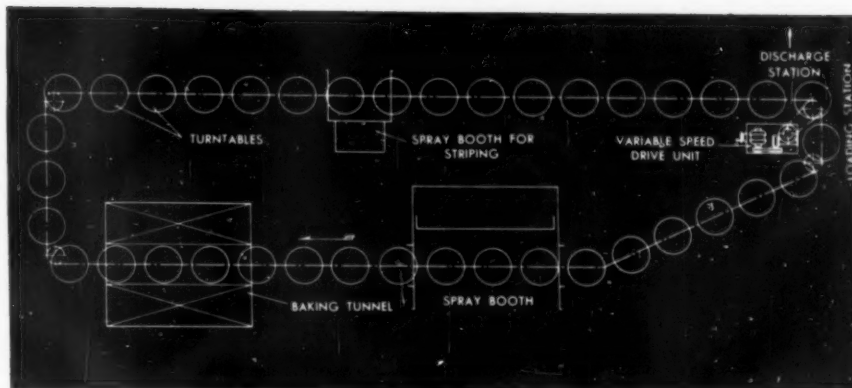


Fig. 1. Diagram of lay-out of new finishing installation showing relative locations of spray booth, baking tunnel, striping booth and loading and unloading stations.

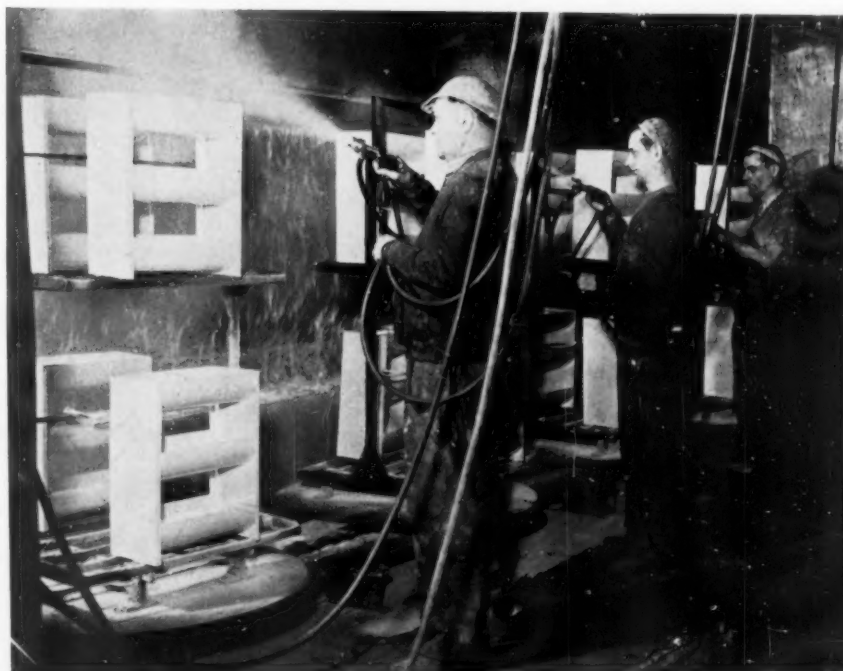


Fig. 2. Operators spraying cabinets. Note the water-wash type collector for spray fumes.

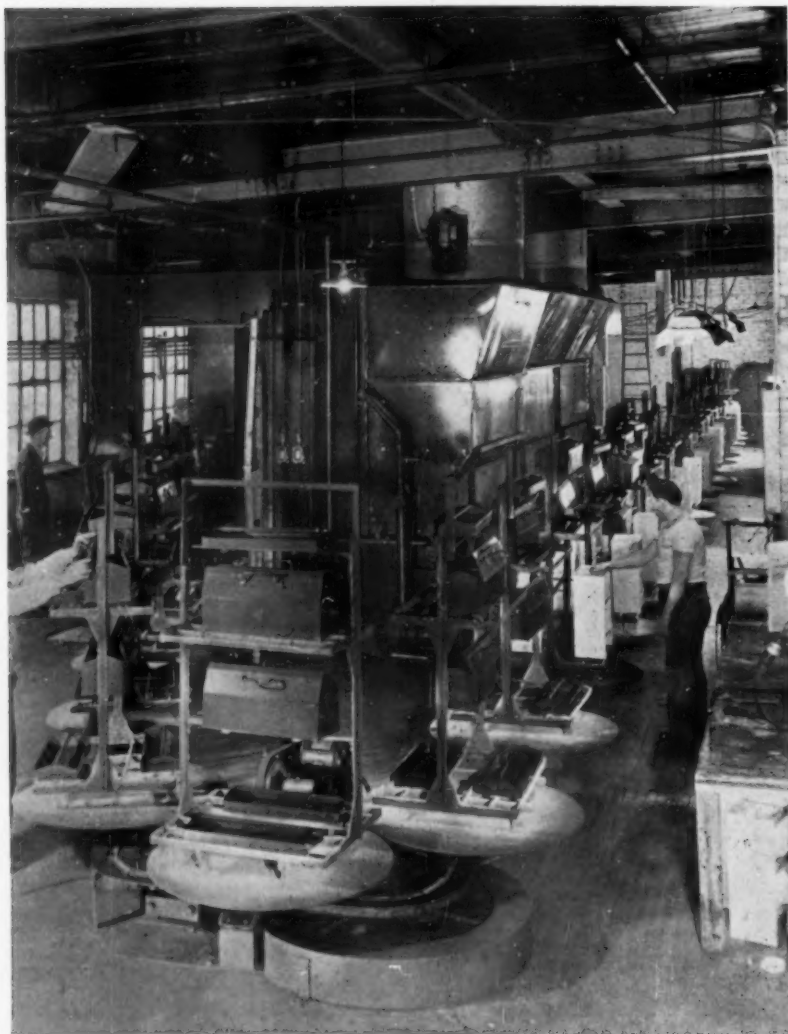


Fig. 3. View of finishing system. On end is loading and unloading station and on left an operator can be seen at the spray booth.

New Finishing Department

Since installation of the new infra-red system, the paint department occupies the fifth floor only, and degreasing of unpainted cabinets is done on this floor also. Unfinished cabinets arriving on the fifth floor are now immediately run through a conveyorized vapor degreaser, utilizing trichlorethylene as a solvent. The degreaser is 9' wide x 12' high x 24' long, of the double chain "Hold-Bar" type, arranged with variable speed control. At normal speed its capacity is seventy cabinets per hour. The trip through the unit for one cabinet requires about four minutes. From the degreaser, cleaned cabinets are placed on the turntable conveyor.

This conveyor consists of a single strand of 6"-pitch steel chain on which are mounted at intervals of 4'-6", revolving turntables 3'-4" in diameter.

Cabinets on the turntable conveyor pass from the loading station through two "Dyna-precipitator" water-wash spray booths, 1-7 feet wide, accommodating one spray operator, and one booth sixteen feet wide in which there are two spray operators. Each operator can turn the cabinet on which he is working by revolving the turntable with his foot.

On leaving the spray booth, the cabinets air dry for approximately four minutes, traveling on conveyor, before entering the infra-red baking tunnel. This tunnel is equipped with

one hundred and twenty 1000-watt enclosed reflector lamps so connected that each bank of six lights is individually controlled. The number of lights in use varies with the size of the work. The baking tunnel is enclosed and equipped with air circulating amnestats. At the normal operating speed of the conveyor, each cabinet remains in the preheat section of the tunnel enclosure approximately $\frac{3}{4}$ minute, in the high heat lamp section about $3\frac{1}{2}$ minutes, and in the heat retention section approximately 3 minutes.

On leaving the baking tunnel, work remains on the conveyor approximately eighteen minutes for cooling before arriving at the discharge stations. Upon removal from the conveyor, cabinets are immediately wrapped and moved onto a double belt powered conveyor approximately forty-three feet long and are carried directly to a single-chain, vertical-tray elevator for discharge to shipping platform or warehouse. The tray elevator is arranged for loading and unloading work at any of five floors.

Many Savings Made

Due to reduced handling of cabinets between various operations, the number of rejects has been reduced by thirty percent. Production of the new one-floor paint department is slightly better than the former two-floor paint department. The present paint department requires one man loading cabinets on the turntable conveyor, three spray operators and two men removing cabinets from conveyor and wrapping, a total of six men against the thirteen formerly required.

The cost of electricity, as against gas for convection ovens, is a third less. There have been noticeable savings in paint costs, and insurance rates have been lowered since installation of this equipment. Maintenance costs have been lowered because of the elimination of the many individual spray booths and ovens.

Floor space required has been reduced fifty per cent, releasing the entire fourth floor for defense work. Since our entry into the war, the conveyor is used entirely for war work—tool boxes, metal cabinets for government administration offices, housing projects, etc., and many other defense materials. The equipment of the entire new paint department was designed and installed by Gifford-Wood Co., Hudson, N. Y.

Ordnance Department Paint Developments*

By E. T. McBRIDE

*Office of Chief of Ordnance,
War Department, Washington, D. C.*

IN order to understand fully the paint problems which the Ordnance Department has undertaken, a knowledge of what is expected of military finishes by the operating divisions is essential.

The Ordnance Department is responsible for the design, development, storage, supply, and maintenance of combat materiel, which includes small arms, artillery, ammunition, tanks, and combat vehicles. The department is organized into four groups, each with a particular function in the successful completion of the ordnance mission. It is the responsibility of the Industrial Service, the group interested in paint products, to design, produce, procure, inspect, and standardize all ordnance materiel. The Industrial Service, through its operating divisions and research engineering staff, conducts tests on experimental materiel, maintains technical liaison, and distributes technical information to the industry, which make it possible for the Ordnance Department successfully to accomplish the manufacturing phase of its mission.

The Small Arms Division, responsible for the design, development, and procurement of pistols, revolvers, pyrotechnic projectors, rifles, machine guns and machine gun mounts (not including those mounts used in combat vehicles), and ammunition for these weapons, presents an interesting field for development to the paint industry. It utilizes the lusterless olive drab enamels of the ES-359 type for the camouflage and protection of metal on machine gun mounts and on wooden ammunition.

The Ammunition Division from time to time has been faced with unique problems which the paint and varnish industry, in cooperation with Ordnance

Department operating facilities, has successfully solved. The most remarkable current advancement in artillery ammunition has been aided by industry's development of a baked phenolic varnish for use on steel cartridge cases. When it was apparent that a shortage of brass would delay the production of cartridge cases, the Artillery Ammunition Division investigated the possibility of utilizing a thin gage steel. The development of a steel cartridge case necessitated protecting it against corrosion caused by weathering and the chemical action of the propellant loading. It was found that copper plating the outside of the cartridge case provides adequate protection against external corrosion. It was the inside of the case, therefore, that required the attention of the paint and varnish industry. In cooperation with the Ordnance Office and Frankford Arsenal, the industry developed a straight phenol formaldehyde varnish. This produces a smooth continuous film which does not chip or scale after drying. The dried film, although tough, is elastic and withstands the abrasion of the propellant loading without serious effect.

A varnish to meet the requirements of Frankford Arsenal's specification must be a straight phenol formaldehyde finish, clear and unpigmented. It must resist toluene, acetic acid, ammonium hydroxide, ethyl alcohol, and ethyl ether. The test film must withstand a baking temperature of 50° F. in excess of that recommended by the manufacturer without softening or otherwise deteriorating. When scraped with a sharp blade, the film must not flake or exhibit other evidence of poor adherence.

Another development of the Ammunition Division is the new method

of bomb painting. In the past, the painting of bombs followed the customary painting of artillery ammunition. For example, the entire bomb was painted to correspond with an artillery shell of the same loading. The present method is to paint the entire bomb a lusterless olive drab and identify the loading by suitable striping. The lusterless olive drab paint used as a protective finish coating of the metal must dry to a dead flat and require no further painting. It must have good color retention and have no tendency to increase in gloss during storage or after application. Inasmuch as bombs are only given one coat of paint, that covering must be complete. The film must be tough and elastic, and must not chip or scale. Bombs, like other ordnance materiel, are often required to lay for some time in field dumps with little or no protection from the elements. In order to meet this requirement, the paint used for bombs must withstand an 18-hour immersion test in cold water without whitening, fading, softening, checking, or failing in other respects.

Artillery shell is still being painted solid colors to indicate shell loading. Paint used for artillery ammunition must withstand weathering and handling without undue chalking or chipping. It is important that the color be maintained and that it be readily distinguished even though splattered with mud. Numerous samples of yellow, for example, have been submitted which are altogether unsatisfactory because the color is not equivalent to the regular chrome pigment specified by the Ordnance Department.

*Presented before the Division of Paint, Varnish, and Plastics Chemistry at the 103rd Meeting of the AMERICAN CHEMICAL SOCIETY, Memphis, Tenn., April 20 to 23, 1942.

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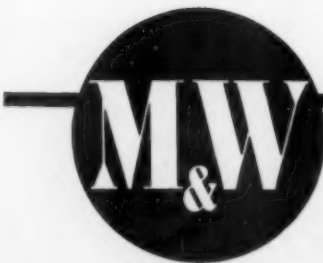
★ ★ **T**he original Duart Wrinkle Enamels, with their desirable qualities of quick drying, durability, adhesion and resistance to marring, are available to manufacturers engaged in war production.

For those manufacturers who do not have the necessary priorities, we have developed alternate Duart Wrinkle Enamels which closely resemble our original Duart Wrinkle Enamels. They can be used on the same surfaces and give similar effects.

One of the chief advantages of Duart Wrinkle Enamels today is ease of application. No primer or sanding is required and they cover surface defects, such as seams and welding marks, in one coat. Even unskilled operators can apply Duart Wrinkle Enamels with uniform results.

Send for technical data bulletin No. 1A.

Booklet, "Information on U. S. Government Specification Finishes," compiled for executives of plants engaged in war production, sent on request.



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Throughout the entire investigation of the Ordnance Department's paint substitution program, conservation of resins, pigments, oils, and solvents has been given prime consideration. When shortages of the essential raw materials were anticipated early last fall, the Ordnance Department joined forces with the Corps of Engineers, the Quartermaster Corps, and industry to effect satisfactory substitutions in the shortest possible time. A committee was formed by these three supply services of the Army in the Office of the Under Secretary of War, and liaison established with industry and the Protective and Technical Coating Section of the War Production Board. Six months of concentrated effort by the Army and industry team ended in April.

Panels of substitute olive drab finishes which had undergone a six months' exposure in Florida were brought to Washington and carefully inspected by the interested Services of Supply. Very little difference in fading and chalking was noticed between the straight and modified alkyd top-coats.

Many producers of high-grade finishes have sought the advice of the War Production Board on substitute oils for China wood oil, the supply of which is very limited. Specially treated castor or linseed oil may provide a satisfactory substitute. It is impossible at this time, however, to offer the industry definite advice as to acceptable substitutes because service tests have not been completed.

Conservation of chrome pigments has become mandatory. The use of lead chromate is a thing of the past, and the utilization of zinc chromate must definitely be reduced. The addition of organic dyes, lakes, or pigments is not generally considered favorable for use with military equipment owing to poor resistance to weathering. A satisfactory pigment is one which retains its color in the paint film, whether in Arctic or tropical theaters of operation. A pigment formulation based on yellow iron oxide and a minimum of zinc chromate has been investigated as a probable alternate.

Although alternate emergency enamels to replace the ES-474 have been investigated, the Ordnance Department requires enamels used on tanks and combat vehicles to be tough and flex-

ible. Paint must withstand the abrasive action of low-hanging branches, weeds, and bushes without an appreciable scraping off of the top coat when these material are actively engaged in the combat area. It would be unreasonable to demand, of course, that the painted surfaces remain wholly intact under cross-country service, but they should withstand rough usage for at least six months. In general, paint has a definite military purpose when it is applied to combat materiel.

The lusterless olive drab finish must provide not only corrosion resistance for the metal, but also must provide camouflage properties which enable the materiel when not actually in motion to blend with the surrounding terrain.

Although the substitution program is only six months old, remarkable gains have been made in conservation and in the development of satisfactory finishes for ordnance materiel.

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Grind Smoother**

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FIRE PROTECTION FOR ORGANIC FINISHING

Guarding Spray Booths and Other Special Hazards as Important as Air Raid Shelters or Camouflage

By P. W. EBERHARDT

Walter Kidde & Company
New York, N. Y.

ONE of our salesmen recently received the following memorandum regarding a request for fire extinguishing equipment to protect a spray booth and drying oven in a plant manufacturing petroleum containers for the government:

"Dear John:

You may remove this request from your files, as subject company has burned out completely.

Attached is a newspaper account of fire. Went out and viewed the results myself, and find that entire plant has been gutted. Subject company will contact us if and when they rebuild.

Yours very truly,
Sam"

The newspaper account accompanying this memorandum showed the results to be even more serious than implied in the letter. Three other shops in the same block-long building were completely destroyed. Total damage was estimated at \$1,000,000. An even greater loss was suffered in the matters of time and production capacity, since the company where the fire started and two of the neighboring companies were working on important war contracts.

As is the case of so many of the other fires sapping our war effort, the cause of this tragedy was revealed as inadequate protection for the type of hazards involved. Today, more than ever before in our history, it is essential that industry fully recognize and guard against specific fire hazards. This means not only having sufficient fire protection equipment on hand, but having equipment especially designed to meet the specific hazards involved in each plant, and in each department in that plant.

The Flammable Liquid Hazard

Probably the most serious special hazard facing manufacturers in these days of mechanized warfare is the flammable liquid. Easily ignited, either by accident or sabotage, it produces blazes of exceptional violence which cannot always be controlled by water and some of the other common extinguishing agents. Yet there is hardly a war industry today which does not employ flammable liquids in some form or other. The alcohols used in making powder and explosives, the paints and lacquers used to protect metal parts all the way from cartridge cases to battleships, the gasoline

used to test tanks and airplane engines, many solvents used for washing and degreasing—all fall in this class.

Fortunately fire protection engineers have discovered during recent years an answer to the flammable liquid hazard. That answer is carbon dioxide or common soda pop gas. Carbon dioxide acts on a fire by cutting off its oxygen supply until the fire can no longer breathe. Slightly heavier than air, carbon dioxide gas penetrates into spaces which other extinguishing agents cannot reach. Completely inert, it eliminates extinguishing agent damage completely, and can even be used with total safety on

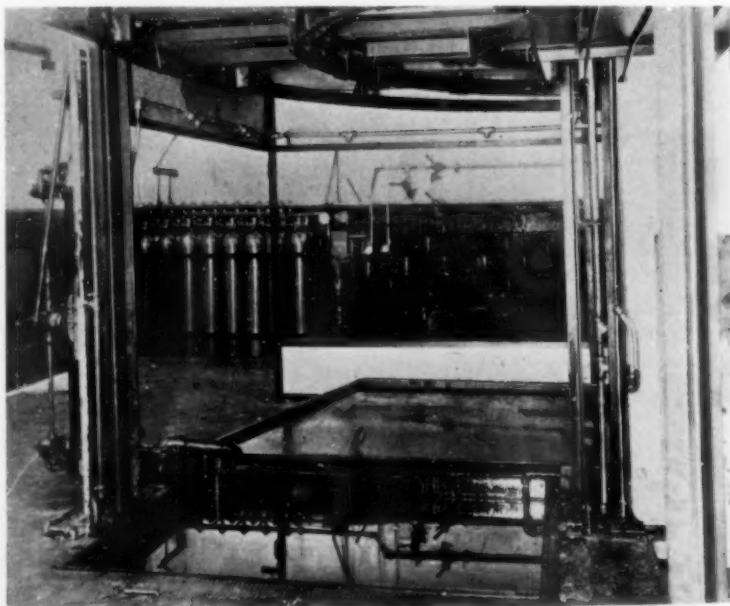
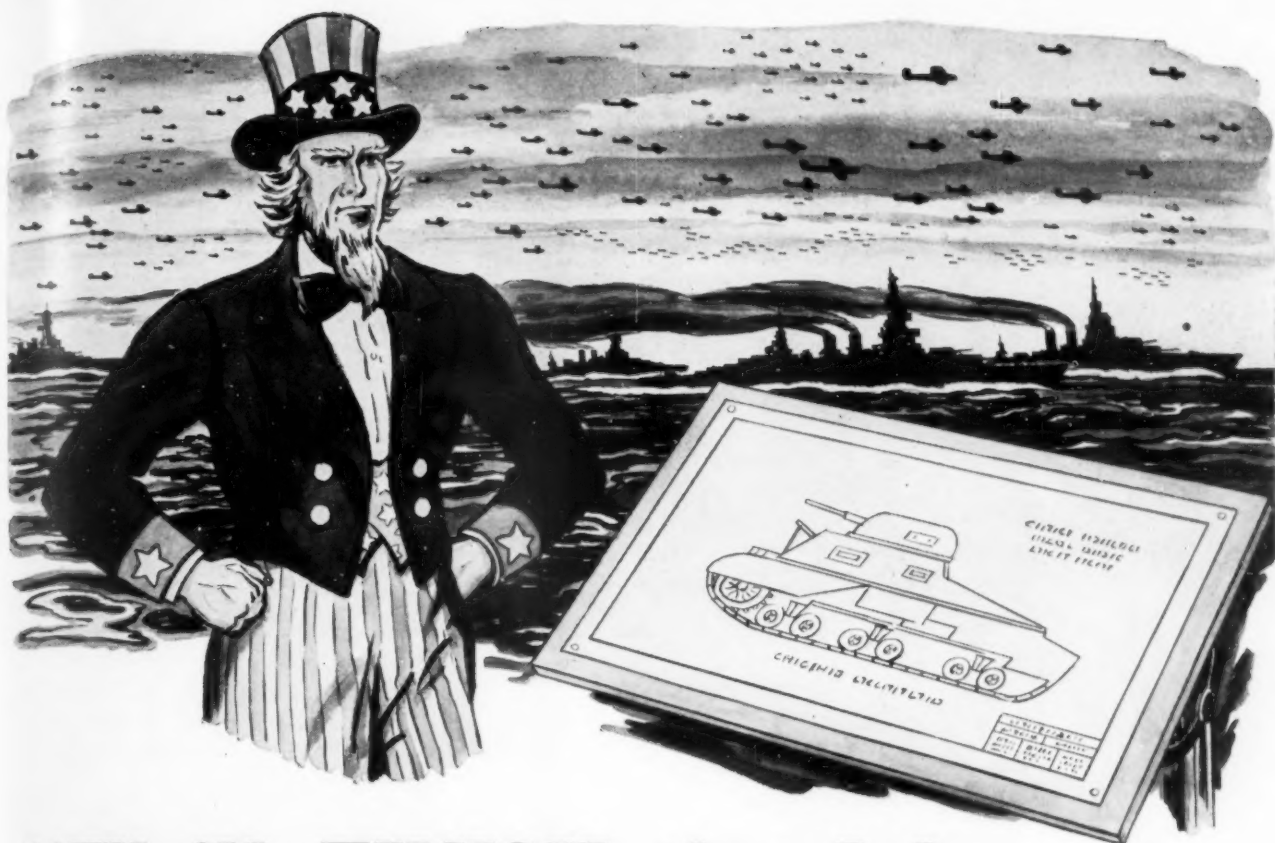


Fig. 1. This conveyor line and dip-tank in a General Motors factory is protected by a built-in carbon dioxide system. The cylinders containing the compressed gas may be seen in the left background. The same system also supplies protection for the dryer to which the material passes after leaving the dip-tank.



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A wise decision Mr. Design Engineer. Not only will your product look better and last longer, but you will speed up production, avoid bottle necks and rejects, and the doubts and difficulties that beset one who experiments with untried make-shifts.

Egyptian lacquers, enamels and synthetics have been giving permanent satisfaction under extreme conditions for a long time. As one of the oldest manufacturers of specific finishes it was natural that our chemists should gear our line to the war effort and develop new formulae to fill exacting Government specifications.

To aid you, whose products are used directly or indirectly in one or more branches of the Service, we have prepared a book giving many of the more important Government finish specifications. Naturally there’s an Egyptian Finish for each one. This valuable loose-leaf book which will be kept up to date by additional sheets as new specifications are issued, will be sent to every legitimate manufacturer who writes us on business letterhead giving title and the general character of the war contract involved. Just ask for Government Specification Book MFID.



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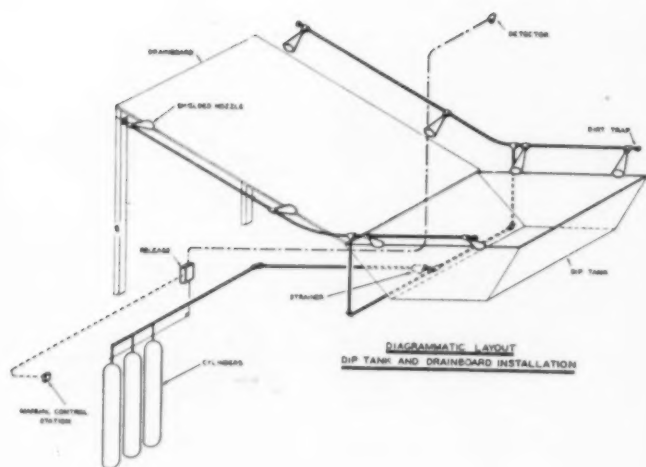


Fig. 2. Diagrammatic layout of a carbon dioxide dip-tank and drainboard installation.

electrical equipment since it is a non-conductor.

CO₂ Extinguishers

There are two types of carbon dioxide extinguishing equipment—portable and built-in. Portable equipment varies all the way from two pound capacity hand units to 2,000 lb. capacity crash trucks used by airplane test fields and oil refineries. In between are a wide number of hand, wheeled and trailer models. Essentially, portable equipment is designed for first aid and emergency fire fighting where the hazard is either small or infrequent.

For really complete protection, and that is what is needed today, the built-in system is recommended. The built-in system consists of four basic elements—(1) one or more steel cylinders of carbon dioxide gas under a pressure of 850 lb. per sq. inch at 70° F.; (2) a valve for releasing the gas; (3) a simple piping system to conduct the gas to the point of the hazard; (4) conical shielded nozzles through which the gas is discharged.

The Total Flooding System

There are two variations of the built-in system. The first, and that which offers the most complete protection, is the total flooding system. In this the nozzles are placed around the periphery of the room in which the hazard



Fig. 3. A portable carbon dioxide extinguisher is kept handy to combat any fires that may develop during the inspection and touching up of automobile parts following dip-tank painting.



Fig. 4. A two cylinder carbon dioxide system stands guard over a dip-tank at the McInerney Spring & Wire Co., now manufacturing springs for Army jeeps. The conical discharge nozzles may be seen at either side of the tank. A former McInerney plant, not protected by carbon dioxide, was destroyed by a dip-tank started fire.

is located. In case of fire, the entire room is flooded with inert vapor until the oxygen content of the air is reduced to a point where it will no longer support combustion in any cubic inch of the room.

The total flooding system can be equipped with either an automatic or manually operated release valve. With the former, the human element is completely eliminated with the system being discharged by a ratio-of-temperature rise detector. When the control is manually operated, it is located at some distance from the actual hazard where it will remain accessible even after a fire has gained headway. On many systems a combination of automatic and manually operated controls is used.

Automatic systems can also be provided with special devices operated by the released gas to sound alarm gongs, close fire doors and windows, and turn off fans, ventilators and electric motors. In cases where there are no fire doors, or it is impossible to close them, the system may be equipped with special screening nozzles to blanket the opening with inert gas and shut off the outside oxygen supply while keeping the fire from spreading.

The quantity of carbon dioxide needed for a total flooding system depends on two factors—the cubic volume of the space being protected, and the nature of the liquid involved. For a hazard such as gasoline, the amount of carbon dioxide needed to protect a given space can be determined from the following table prepared by the National Fire Protection Association.

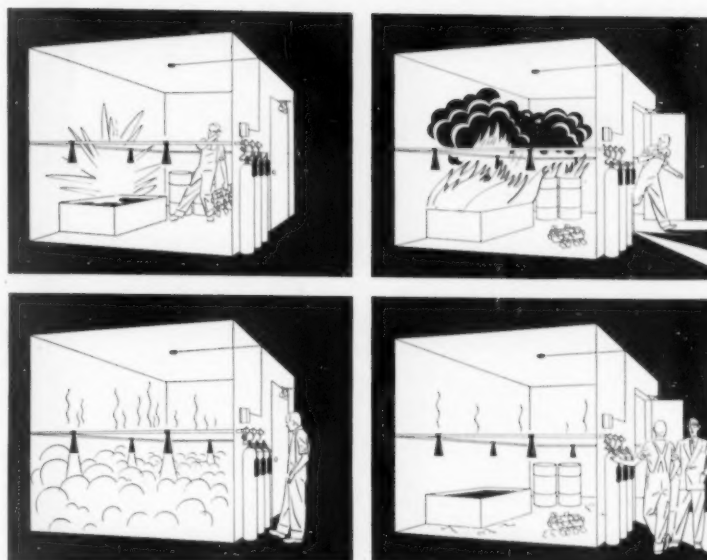


Fig. 5. These drawings show how the "total flooding" carbon dioxide system extinguishes a fire without the slightest dependence on the human element. The system is automatically discharged at the first sign of flame by a heat sensitive detector.

	Cu. ft. space protected
16 cu. ft. per lb. of gas up to	1600
18 cu. ft. per lb. of gas up to	4500
20 cu. ft. per lb. of gas up to	50000
22 cu. ft. per lb. of gas over	50000

In certain cases where there is little danger of simultaneous fires breaking out, the same bank of cylinders may be used to protect two or more spaces through the use of directional valves. In such cases the amount of gas required is determined by the volume of the largest space.

The Local Application System

The second type of built-in system is known as the "local application"

type. It differs from the "total flooding" system in that the nozzles are arranged to discharge the gas directly on a specific hazard such as a diptank or washer rather than to fill the whole room with carbon dioxide. As with the "total flooding" system, control of the "local application" type can be either automatic or manually operated.

The "local application" system is generally used in cases where the hazard is highly localized such as a single small dip tank in a large processing room. Today it is also being used to an increasing extent as a built-in part of certain machinery such as the industrial washers used in aircraft engine factories.

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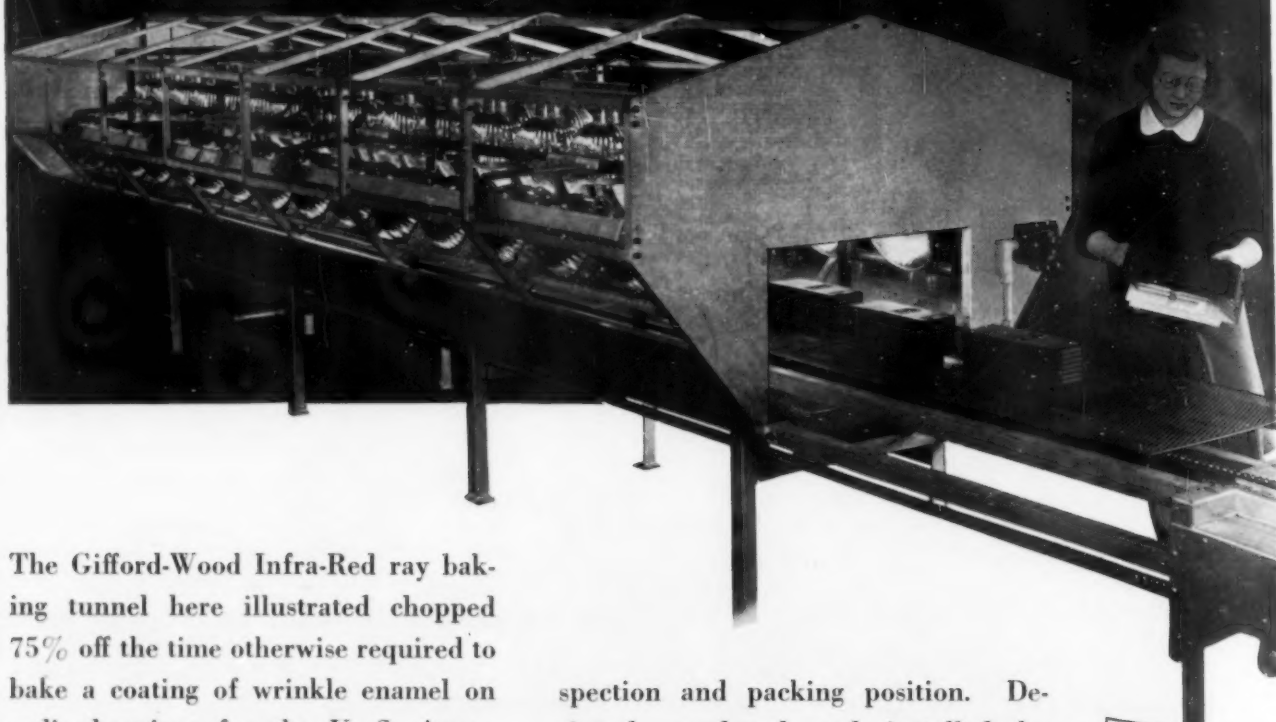
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METAL FINISHING, October, 1942

Shop Problems

Problem 2. Cost of Solids

An air drying finishing material weighing 8.0 pounds per gallon and containing 25.0 per cent by weight of non-volatile solids is purchased for \$2.40 per gallon. This material is prepared for application by adding two parts by volume of thinner to three parts by volume of unreduced material. The thinner costs \$1.05 per gallon.

It is desired to know the cost per pound of solids in the finishing material before reduction and after reduction in order that the cost of added thinner may be determined.

Solution: From the given data it may be seen that one gallon of the unreduced finishing material contains $25.0/100 \times 8.0 = 2.0$ pounds of solids. Since the unreduced material costs \$2.40 per gallon, the cost per pound of solids is, therefore, $\$2.40/2.0 = \1.20 .

It was noted that the thinning ratio is three parts by volume of unreduced material to two parts by volume of thinner. A mixture of three gallons of unreduced material and two gallons of thinner costs $(3 \times \$2.40) + (2 \times \$1.05) = \$9.30$. In this mixture there are $3 \times 2.0 = 6.0$ pounds of solids. Whence, the cost per pound of solids in the reduced material is $\$9.30/6.0 = \1.55 .

By subtracting the cost per pound of solids in the reduced material from the cost per pound of solids in the unreduced material, the cost of added thinner per pound of solids is obtained. Thus, $\$1.55 - \$1.20 = \$0.35$. In other words, for each pound of non-volatile solids, thirty-five cents worth of thinner is used.

Next month: Adjusting Solids Content.

Shellac Solvents

Question. Will you be so kind as to advise us what solvents other than methyl alcohol and denatured ethyl alcohol might be used to cut orange shellac. We are particularly interested in those solvents which will increase the drying time, that is, solvents which slow the rate of drying.

Answer. According to published

data, there are a number of solvents of slower evaporation rate than those you mention and in which orange shellac is more or less soluble. Some of these are isopropyl alcohol, normal hexanol, normal butyl alcohol and normal butyl acetate.

It is suggested that you make up a number of cuts using various proportions of your regular solvent and one of those mentioned above. Perhaps a good starting point would be a fifty-fifty mixture. After testing this one combination for drying time, the proportion of slower solvent could be varied to suit your particular requirements.

On Spray Gun Pressures

Question. Do you have available any information on setting spray gun air and fluid pressures by means of a mathematical formula. We understand that it is possible to calculate what pressures should be used to get best results instead of having to find them by trial and error. We will anxiously await your answer. If such calculations can be employed, it would help tremendously in our paint shop where we are having some difficulty in regulating our guns.

Answer. To our knowledge there is no mathematical formula such as you mention. There may be a formula, however, and we will welcome correspondence from our readers who have done or are familiar with any work on the subject.

As we see it, there are so many factors involved—type and viscosity of

finishing material, kind of gun used, nature of work to be finished, etc.—that setting gun pressures correctly becomes a matter of experience, trying various pressures until a smooth uniform film may be applied in a minimum of time with a minimum of overspray.

Your spray gun manufacturer can be of great help in your problem. Knowing the kind of work you do and the finishing material which you employ, he can make recommendations that will produce the best results.

Electric Sander

Detroit Surfacing Machine Company, 7433 W. Davison Street, Detroit, Mich., have issued a folded leaflet describing their electric sander—Model XL—which they recommend for sanding, rubbing, polishing and feather edging.

The sander and several of its practical applications are illustrated.

The leaflet may be secured upon request from the company.

Synthetic To Replace Rubber

Haydenite, a new synthetic formulated from safety glass plastic, has been announced by the Stanley Chemical Company of East Berlin, Connecticut.

This material is being used to replace rubber in army raincoats and is expected to be drafted for other products using waterproofed fabrics, such as life-belts, tarpaulins, hospital sheets, pontoons, etc.

It is less expensive than previous waterproof coatings and is easy to apply.

For complete details, address the Stanley Chemical Company.

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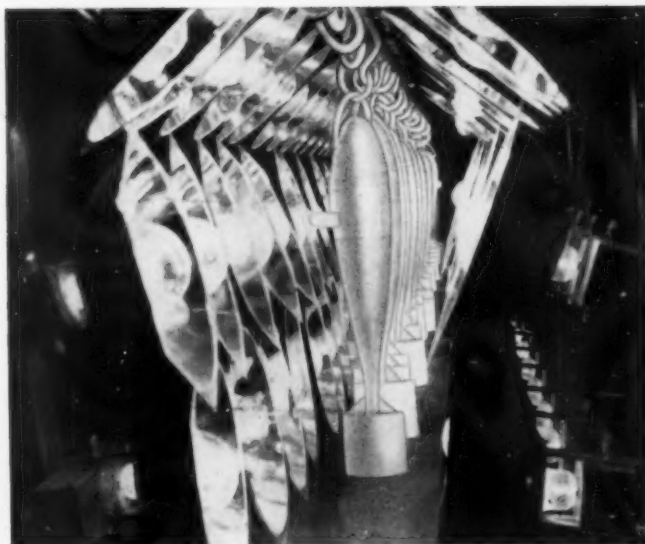
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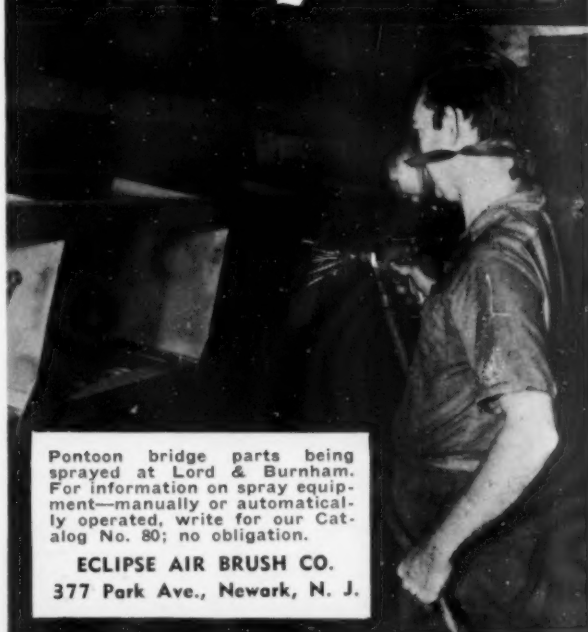
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Patents

Organic Coating

U. S. Pat. 2,292,468 E. F. Oeffinger & H. G. Stauffer, assignors to E. I. duPont de Nemours & Co., Aug. 8, 1942. A finishing composition comprising 10-50% plasticizer, 10-75% of the resinous reaction product of urea, formaldehyde and monohydric alcohol, and 10-50% of the resinous reaction product of ingredients consisting essentially of a maleic compound of the class consisting of maleic anhydride and maleic acid, glycerol and a modifying ingredient of the class consisting of rosin and the resin acids derived therefrom, the maleic compound on the basis of maleic anhydride constituting about 5-25% by weight of said ingredient, the glycerol about 3-16%, and the modifying ingredient on the basis of rosin constituting the remainder, said resinous reaction product of urea, formaldehyde and monohydric alcohol containing said alcohol in combined form in amount of from one-half to about one molecule of alcohol for each molecule of urea, said last named resinous reaction product yielding upon treatment with zinc chloride and acetic anhydride the acetate of said alcohol.

Organic Coating

U. S. Pat. 2,291,843 R. C. Swain and P. Adams, assignors to American Cyanamid Co., Aug. 4, 1942. A coating composition containing substantial proportions of ester gum and a melamine-formaldehyde resin which has been alkylated with an alcohol containing at least 2 carbon atoms, wherein the molal ratio of formaldehyde to melamine is at least 2.5:1 and wherein the weight ratio of ester gum to melamine-formaldehyde resin is at least 3:2.

Organic Coating

U. S. Pat. 2,291,460 C. B. Francis, July 28, 1942. A metal coating mixture comprising by volume 3 to 20 parts of "refuse palm oil," from 1 to 7 parts turpentine and petroleum oil having a flash point of at least 250°F. and a fire point of at least 300°F. as determined by the open cup method.

Organic Coating

U. S. Pat. 2,291,284 J. H. Lowell, assignor to E. I. duPont de Nemours & Co., July 28, 1942. A sprayable, bluish-resistant, high solids coating composition comprising cellulose nitrate and a volatile liquid organic vehicle which has a solvent power for cellulose nitrate of at least about 80% that of absolute ethyl acetate as measured by the viscosity and which has a calculated temperature depression characteristic during spraying of between 13.5° and 15.5°C. when water sprayed under the same conditions gives a depression of about 11.2°C. of which

temperature depression 40 to 80% is contributed by the partial evaporation of cellulose nitrate solvents having a temperature depression greater than that of toluol.

Paint Composition

U. S. Pat. 2,291,091 D. W. Robertson, assignor to National Lead Co., July 28, 1942. A paint composition of paste consistency consisting of a pigment portion of about 89% and a vehicle portion of about 11%, the pigment portion consisting of a mixture of titanium dioxide pigment and basic carbonate white lead pigment, the titanium dioxide being between about 1% and about 10% by weight of said pigment mixture and the basic carbonate white lead mixture constituting the balance, the vehicle portion consisting of drying oil, a drying oil-soluble synthetic resin and thinner, the amount of said resin being between 15 and 40% based on the combined weight of drying oil and resin and the amount of thinner being sufficient so to reduce the viscosity of said vehicle portion that when the vehicle portion is mixed with the pigment portion the resulting paste will have a consistency substantially the same as the standard "soft paste white lead."

Spraying Apparatus

U. S. Pat. 2,287,458 R. W. Tracy, assignor to The DeVilbiss Co., June 23, 1942. A spraying apparatus including a plurality of air jets of novel design.

Corrosion Prevention of Iron

U. S. Pat. 2,284,241 J. H. Werntz, assignor to E. I. duPont de Nemours & Co., May 26, 1942. A rust proofing composition consisting of a solution in an inert volatile solvent, of the acid phthalates or the acid maleates of the mixture of normal primary monohydric aliphatic alcohols obtained by the carboxylic reduction of coconut oil.

Example:

Light mineral oil	10%
Octadecyl acid maleate	2%
Low flash naphtha	88%

Organic Coating

U. S. Pat. 2,290,133 R. C. Swain and P. Adams, assignors to American Cyanamid Co., July 14, 1942. A coating composition containing a substantial proportion of ester gum and a melamine-formaldehyde resin which has been alkylated with an alcohol containing at least two carbon atoms, wherein the molal ratio of formaldehyde to melamine is at least about 4:1 and wherein the weight ratio of melamine-formaldehyde resin to ester gum is at least 3:2.

Organic Coating

U. S. Pat. 2,293,428 L. S. Engle, assignor to Interchemical Corp., August 18, 1942. A coating composition comprising a varnish made from China-wood oil and oil soluble phenol-formaldehyde resin, said composition being of such constitution that on storage it increases in viscosity markedly and progressively, and eventually gels, and sufficient terpinolene to maintain the viscosity of the composition substantially uniform on storage.

Coating Aluminum

U. S. Pat. 2,279,252-3 C. J. Slunder, assignor to Aluminum Co. of America, Apr. 7, 1942. Odorless oxide coatings on aluminum to which ice does not adhere, for use in refrigerators, etc., are produced by impregnating the oxide surface with an aqueous solution of a material selected from the group consisting of the substantially alkali neutralized sulfonated and sulfated fatty alcohols and the substantially organic base neutralized sulfonated and sulfated fatty alcohols. Also plus a wax emulsion in the proportion of 0.25 to 2.5 parts to each part of the alcohol.

Example: 2 g./l. of a wetting agent such as Gardinol, Avitex, Duponol, etc., in which the articles are immersed, after anodizing or oxide coating by immersion, for 20 minutes at boiling.

Calorizing

U. S. Pat. 2,279,268 L. V. Adams, assignor to General Electric Co., Apr. 7, 1942. A method for calorizing ferrous metals which comprises applying a paint consisting of a paint vehicle and granular aluminum, said vehicle containing about 21.4% zinc soap and 78.6% solvent for said soap, then drying and heating to about 600° - 700° C.

Example:

Zinc oleate	21.4%
Toluol	78.6%
Use 48.6% of the above vehicle and 51.4% granulated aluminum.	

Corrosion Prevention of Magnesium Alloys

U. S. Pat. 2,288,995 H. K. DeLong, assignor to The Dow Chemical Co., July 7, 1942. A method of treating magnesium surfaces to form a protective coating and a good paint base which comprises subjecting the article to a solution consisting essentially of water, a water soluble fluoride and a strong mineral acid. The fluorine content should be 0.2 to 6% by weight of fluorine. The acid may be 4-20% by weight of nitric acid or 0.2 to 7% by wt. of hydrogen chloride.

Example:

Hydrogen fluoride	1.2% by wt.
Hydrogen chloride	0.63% " "

Example:

Hydrogen fluoride	3.6% by wt.
Nitric acid	11.6% " "

Immerse one minute at room temperature.

Organic Coating

U. S. Pat. 2,293,038 L. Auer, August 18, 1942. A coating composition, comprising a solution of a cellulose derivative lacquer base chosen from the class consisting of cellulose esters and others in an organic solvent, and also comprising a fatty oil having dispersed therein at a temperature of 100°C. to 300°C. not more than 10% of a polar compound but enough to improve dispersing properties in said solution, said polar compound having dispersing properties due to its being soluble in said solvent, the ratio of said fatty oil to said lacquer base being greater than unity and said solution being free from tendency to flocculate.

Suggestions For Conserving Paint Brushes

By R. O. PETERSON

Manager, Technical Dept.
The Osborn Mfg. Co., Cleveland, Ohio

BECAUSE of the shortage of bristles the following suggestions for conserving brushes are offered.

The Federal Government has ruled that all paint and varnish brushes using the longer bristles must be diluted with at least 45 per cent hair or other materials. The order is due to a scarcity of bristles, which are obtainable from hogs raised only in Russia and China. The bristles have a special peculiarity which enables them to hold paint and permit it to spread properly. This is a "flag" or multiple-spreading end of the bristle, which has not been successfully duplicated artificially.

When not in use, brushes should be kept suspended in a solution of turpentine and linseed oil, or any other

vegetable oil specially prepared for that purpose.

Paint or any other vehicle in which brushes are used should not be permitted to harden in the bristle, since this makes cleaning more difficult. Accumulation of any paint vehicle in the heel of the brush should be prevented.

Never immerse a brush in water, especially those brushes that are made with 45 per cent hair. If it is cleaned in turpentine or lacquer thinner and then washed in soap and water, all the soap should be rinsed out, the bristle combed straight, and the brush wrapped in a paper or a cloth and thoroughly dried before being used again.

Because oil and water do not mix, a

brush washed in water and used again before it has dried thoroughly will be spoiled when dipped in paint, varnish or a paint vehicle. Furthermore, brushes should not be cleaned in kerosene.

Use of the right type of brush for the specific job is important. Do not abuse the pure-bristle brushes now in use, because brushes that are made under the new government regulations are not as efficient as those made entirely of bristles. If properly used, all brushes will last longer, however.

If you have some old pure-bristle brushes that are badly worn but could be cleaned and used, we suggest that you use them, for they still may be more effective than the new mixed hair and bristle brushes.



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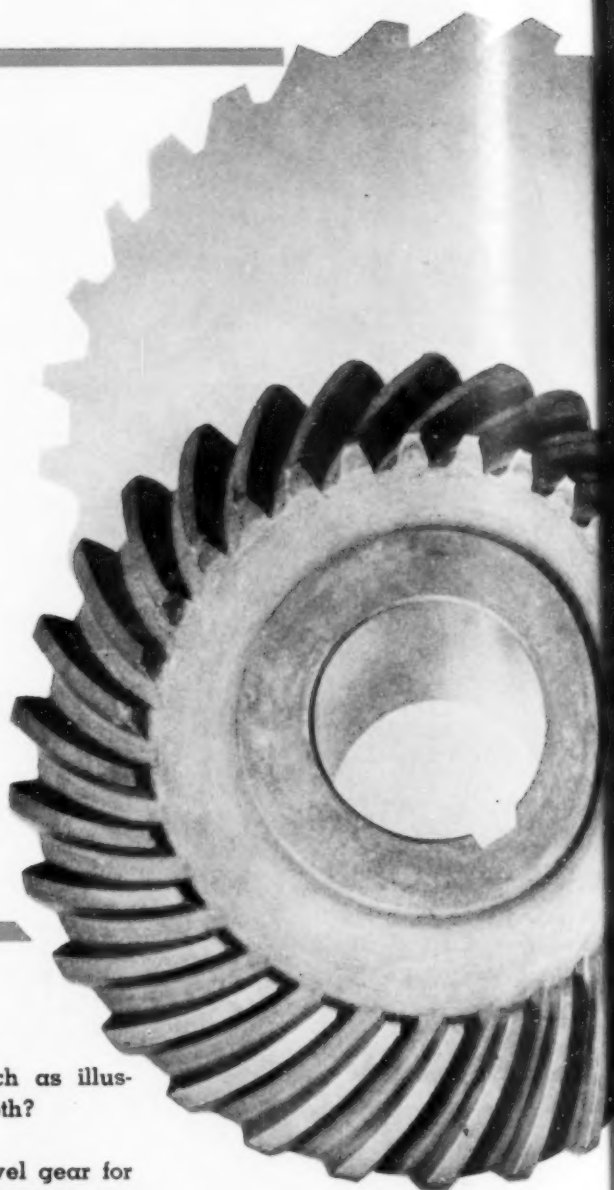
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HOW would you remove the burrs on a gear such as illustrated? By filing? A hand burring tool? Emery cloth?

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Maybe war production in your plant is bringing to light burring problems. Maybe it's a small bushing—a crank shaft—piston ring. Whatever its nature or size, the Lea Method of Burring may be the only way to cut costs, reduce rejections, and work with closer precision. Or, if you have a polishing operation that isn't going too well, remember that Lea Technicians are the metal industry's specialists in polishing. Write us in detail about your burring or polishing problem. Send sample of the work, if practicable.



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SALT SPRAY SPECIFICATIONS

ONE of the finishing industry's biggest bug-a-boos is the salt spray specification. It is being widely used as a criterion of corrosion protection in war goods specifications. The specifications, in many cases, are ridiculous and wasteful of labor and materials.

If you complain about the salt spray specification, the response may be, "If you can tell us of any better test, we'll use it."

Let us look at one of the most harmful applications of salt spray, namely that for zinc and cadmium coatings. Specifications call for from 100 to 500 hours of salt spray and the same specification may apply to both zinc and cadmium.

Zinc unfortunately is attacked much more rapidly than cadmium by salt spray and much heavier coatings of zinc must be applied than cadmium to meet the same salt spray specification. However, extensive outdoor exposure tests conducted by both the A. S. T. M. and the American Electroplaters' Society have shown that zinc protects steel equally as well or better than cadmium, thickness for thickness. These important conclusions are apparently overlooked by most specification writers.

It is not our intention to elaborate on the inaccuracies and poor reproducibility of the salt spray—and there are many. Rather it is our desire to point out, that for zinc and cadmium, there is a better basis for specifications than salt spray, and that basis is the thickness specification, preferably minimum thickness on significant surfaces.

There are two easy methods for determining the thickness of zinc and cadmium plates. One method is the drop test which is destructive of the plate but not the metal base, and the other is the "Magne-gage" method which destroys neither the coating nor the metal base. Both of these methods give greater accuracy than the salt spray; they are quicker to run and they mean more.

As long as salt spray specifications are used for zinc and cadmium, there will be less substitution of zinc for cadmium because it involves much more metal and more labor. With cadmium being scarcer than zinc, this stumbling block should not be placed in the way.

If you are a specification writer and do not have the proof that the salt spray is a fallacious criterion of relative protective value of zinc and cadmium plate on steel, write us and we will tell you where to find ample proof.

If you know the facts—change the specifications to thickness and help the finishing industry turn out finished goods faster to win the war.

Brass Plating

THE operation of brass plating solutions to get uniform results has always been difficult. Usually the plater has operated for "color" and the alloy composition could vary considerably. However, much of the brass plating now being done is for bonding of rubber which requires that the zinc content of the brass plate be within 24 and 35%.

The ratio of copper to zinc is affected by almost every variable in plating—current density, temperature, pH, free cyanide, impurities, copper-zinc ratio in solution, and very markedly by ammonia content.

Another phenomenon which confuses the plater is that the color of the brass plate is not a true criterion of the copper or zinc content. Thus, for example, a reddish plate may be obtained (particularly at low current densities) the color of which may lead one to believe that the copper content is high and the zinc low. Actually, however, the zinc content may be high, e. g. of the order of 45-47 per cent. The writer found this to be true in plating cylinders, and Coats, on plating tea-cup shaped shells, stated "The brass deposit on the outside of the cup was of a normal canary yellow (analysis—zinc: 29-31%); the inside was red (analysis—zinc: 44.0-47.7%)".

It is not our intention here to present a treatise on brass plating but to point out the many variables and the sources of good information on the subject. The following conclusions on the effects of variables on the brass deposit are not true for *all* conditions but for most: Current density—an increase raises the copper content; temperature—an increase raises the copper content; pH—an increase lowers the copper content; free (?) cyanide—an increase raises the copper content; ammonia content—an increase drastically lowers the copper content.

The most notable works on brass plating are those of L. C. Pan [Trans. Electrochem. Soc. 74, p. 425 (1938)]; H. P. Coats [Proceedings 24th Annual Convention, American Electroplaters' Society, pp. 198-217 (1936)] and J. H. Monaweck [Trans. Electrochem. Soc. 82; pp. 331-338 (1942)]. Other works of merit are those of Ferguson and Sturdevant [Trans. Electrochem. Soc. 38, 167 (1920)]; G. B. Hogaboom [Monthly Rev. Am. Electroplaters' Society; 17, 5 (1930)].

Pan's work was concerned largely with the effects of ammonia on the color and composition of brass electrodeposits. Monaweck just recently showed that small amounts of ammonia may be present in even freshly made brass plating solutions forming from sodium cyanide. He recommended a practical method of control of the ammonia content. Coats' work is the most comprehensive work ever done on the subject of brass plating for rubber adhesion and almost all the variables are considered.

Advertising Under War Contracts

WAR contract manufacturers will not be denied the privilege of using at least part of their income for advertising purposes, it was indicated by the correspondence of Donald M. Nelson, Houlder Hudgins and Robert B. Patterson.

These expenditures may be paid out of cost-plus-fixed-fee and fixed-price contracts. The amount will be further governed by the nature of the advertising. For example, a reasonable sum will be considered allowable for the support of technical and trade journals which act as organs of information dissemination to the industry.

This policy is contrary to the general rule which does not admit advertising as an item of cost on the basis that it is unnecessary when doing business with the government. The advertising placed in trade journals, however, may now be considered an "operating expense" on the premise that such publications are of value to the industry and should therefore be maintained.

According to Secretary Morgenthau, "The test of whether expenditures for advertising are deductible is whether they are ordinary and necessary and bear a reasonable relation to the business activities in which the enterprise is engaged. This is not intended to exclude institutional advertising in reasonable amounts or good will advertising calculated to influence the buying habits of the public. If such expenditures are extravagant and out of proportion to the size of the company or to the amount of its advertising budget in the past, or if they are not directed to public patronage which might reasonably be expected in the future, such payments will be disallowed as deductions".

Mr. Nelson's interpretation of the matter as it concerns plants on nearly or all-out war production is revealed in a letter to Mr. Patterson. He states, "When an industry has been substantially or wholly converted to war production, the Price Adjustment Boards will recognize that the amount of advertising expenditure necessary to maintain a trade mark or brand name of a product in the public consciousness is much smaller than that required for promotion of the same product in a normal competitive market".

It has been recommended by the Procurement Policy Committee that such advertising expenditures be reviewed by the Price Adjustment Boards when they consider the question of company-wide excess profits on war business.

In line with the policy thus being formed, it might be well for manufacturers to have product advertising take precedence over the institutional type on the ground that material which tends to be technically informative does a greater service to the industry and thus to the war effort.

The Use of Copper In Selective Carburizing*

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THE use of copper as a means of providing selective carburizing began to receive widespread attention sometime during the period of 1910 to 1914 due primarily to the advent of the motor car industry.

During this period and up until late 1922, a considerable amount of work was done on this subject. Much of it was prompted by a desire to find something better than copper that might be more easily applied and removed.

From 1922 to the present time, there has been, at least as far as publications are concerned, very little work done on this subject with the result that those of us who are comparatively new in the field are not at all well acquainted with the work that went on during the period of 1914 to 1922.

Review of Procedures

With this in mind we shall concern ourselves first with a brief review of what was done a number of years ago.

Among the methods and materials that were tried during this period are the following¹:

1. Immersion deposits of copper from sulfate and chloride baths.
2. Shrink on steel sleeves where feasible and remove them later.
3. Copper deposited electrolytically from both cyanide and acid baths.
4. Electrodeposited nickel.
5. Electrodeposited tin.
6. Sprayed metal coatings (Schoop² process at that time).
7. Leaving critical surfaces slightly oversize and grinding off the excess case.
8. Packing with only surfaces to be hardened exposed, all other surfaces to be packed or clamped into intimate contact.
9. Clay, loam, and asbestos wrappings.
10. High temperature resistant paints and enamels.
11. Putty of various compositions.
12. Mixtures of sodium silicate with clay, calcium hydrate, sand and other materials.
13. Mixtures of clay and other inert substances.

The use of immersion coatings of copper was originally developed from the work of "de Dion Bouton"³; however, most later investigators gave very little consideration to immersion coatings because of the extremely unreliable results obtained. However, there are at least one or two plants using immersion coatings of copper today and apparently

with some degree of success, at least as far as their requirements are concerned. Taking this as the exception, however, the bulk of the work has been with the heavier electrodeposited coatings and for the most part, produced in a cyanide bath, although there are some references to the use of acid baths.

Thicknesses of plated copper recommended to prevent carburizing ranges from 0.0004"⁴ to 0.002"⁵. Some authors have attempted to correlate thicknesses with carburizing temperature or time, whereas others have apparently selected a figure on a more or less arbitrary basis.

Periodic attempts were made to use coatings of sprayed copper (Schoop Process^{6,7}). These, however, met with but little success because of the increased cost of application plus the fact that such coatings are extremely porous.

Non-Metallic Coatings

Wood and McMullan⁸ list a large number of mostly non-metallic coatings, some of which produced excellent results; however, most of them were not particularly good. Their most satisfactory mixture was one composed of sodium silicate and asbestos. Various mixtures of the following with sodium silicate were tried with but little success.

Magnesium oxide
Aluminum oxide
Silex
Zinc oxide
Kaolin
Flint clay
Lime
Borax
Soda ash

A more or less general conclusion reached by Wood and McMullan was, that in order to obtain a non-metallic substance which would prevent carburization, it would be necessary to have a material the adherence of which was of the order of copper and because of this adherence, would be equally as difficult to remove.

Of the materials tried by them they noted a lesser degree of protection against decarburizing than against carburizing.

The mechanical methods of preventing carburization suggested are still being used in cases where they are applicable. In our own plant perfectly flat and uniformly shaped

* Presented at the 30th Annual Meeting of the American Electroplaters' Society held June 8-10, 1942 at Grand Rapids, Mich.

cams and gears are packed together in such a manner that the flat sides protect each other.

High temperature resistant paints and enamels were always found to contain too many voids after being brought to the carburizing temperature, due probably to the combustion of organic matter. This also probably contributed to the local hardening in spots during this combustion.

Metallic Coatings

The use of nickel was the subject of some controversy, some claiming that it could be used satisfactorily.

Tin can be used on surfaces upon which it can be kept in place but due to high carburizing temperatures this of course is almost impossible except upon specially shaped surfaces.

The purpose of this present work was to attempt to make some comparisons and determine whether or not some of the more modern copper baths would produce deposits which are more effective for selective carburizing than the standard sodium cyanide baths. Also included because of general interest are some observations made on methods of measuring the thickness of copper deposits.

Panels Used

The samples selected for the tests were made of cold rolled strip steel and were approximately 1" x 2½" x 3/32". The surface of the panels was reasonably free from imperfections and for the most part represented the type of surface that we most often encounter in our own work. While no actual analysis of these panels was made, this particular lot of steel was accepted as complying with the following specifications:

Carbon	.05 to .15%
Manganese	.30 to .60%
Sulfur	0.4% max.
Phosphorus	0.4% max.

All the panels were first copper plated or coated as indicated on all faces, and later (before carburizing) ground off one of the longer edges (3/32" x 2½" side). This was done so that a comparison could be made of penetration of carbon on coated and uncoated surfaces on the same panel.

Plating Baths

The copper baths used consisted of the conventional cyanide and sulfate baths, made up according to Blum and Hogaboom with the exception of the cyanide bath, to which was added enough sodium hydroxide to maintain a pH 13.2, and the operating temperature was increased to 150 to 160° F.

These were compared with the following types of bright copper: two bright acid copper baths, one bright cyanide bath, and two regular cyanide baths, one made bright by the addition of lead and the other modified by means of addition of cadmium. Also included were a few of the so-called "Black Oxide" coatings, cuprous oxide coatings,* reduced cuprous oxide coatings,* and some phosphate coatings.

Conditions

The carburizing compound ("Rapid Carburizer") used was the same in all cases and was obtained from the Park Chemical Company in Detroit.

The temperature was maintained by means of a Leeds &

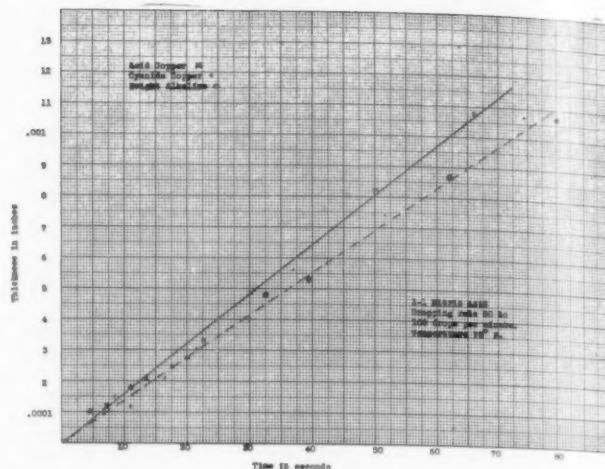


Fig. 1. Curves showing thicknesses of copper dissolved by 1:1 nitric acid at 70° F. for deposits produced in acid, alkaline and bright alkaline copper solutions.

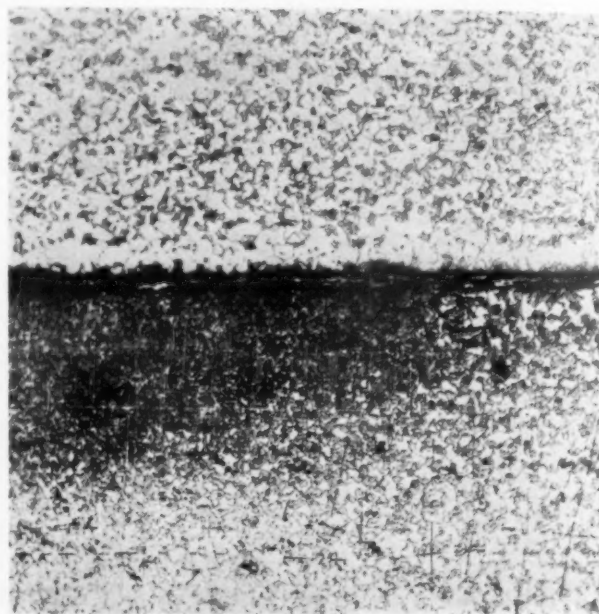


Fig. 2. Photomicrograph of porous copper deposit showing rather heavy carburization. Mag. 100x.

Northrup automatic temperature controller, at 1750° F. throughout all of the test runs.

The carburizing furnace used was what is known as an American Box or Batch Type Carburizing Furnace and was electrically heated.

Thickness Tests for Copper

As previously mentioned, some observations were made relative to methods used for determining the thickness of copper deposits. Of the chemical methods available we have adopted and highly recommend for rapid routine work by untrained personnel, the use of a modification of the method originally proposed by R. E. Maeder.¹⁰

This method was to allow a drop of dilute nitric acid (1:1) to remain upon the plate in question for fifteen seconds, at which point the acid was washed off and a fresh drop was applied. This procedure was carried out until the

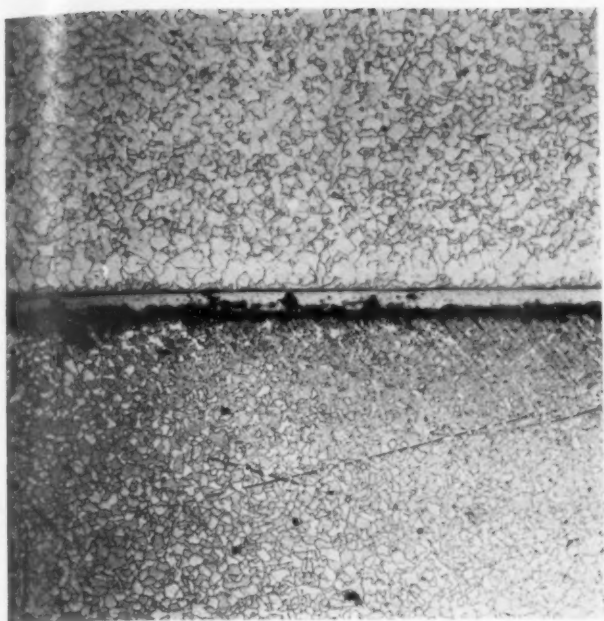


Fig. 2A. Upper half of deposit is free from porosity and shows no penetration. Mag. 100x.

base metal was exposed. Each 15 seconds was equivalent to 0.0001" of copper. The modification proposed is to substitute the standard dropping method (80 to 100 drops per minute) for the single drop. This method is fast and reasonably accurate, although we have found some difference in the rate of reaction with various types of deposits as is indicated in Figure I, and while we have no proof, it is our opinion that these variations are due almost wholly to variations in the density of the deposited copper.

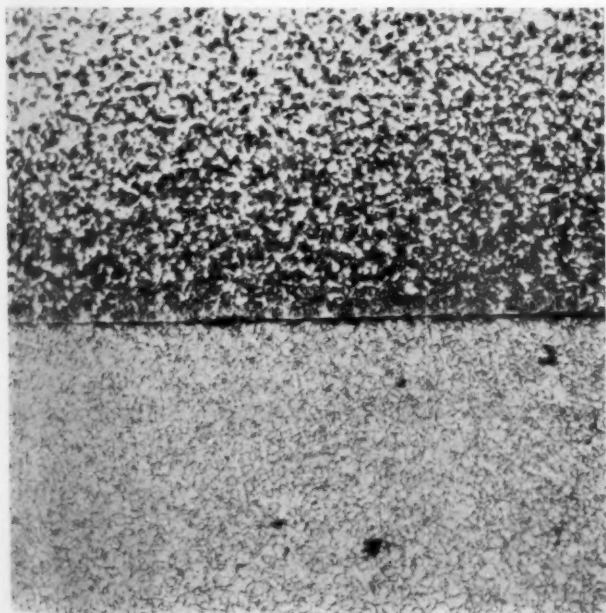


Fig. 3. Upper half shows penetration giving a structure about equivalent to 1020 steel. Lower half is another panel in the cuprous oxide group showing no carburization. Mag. 100x.

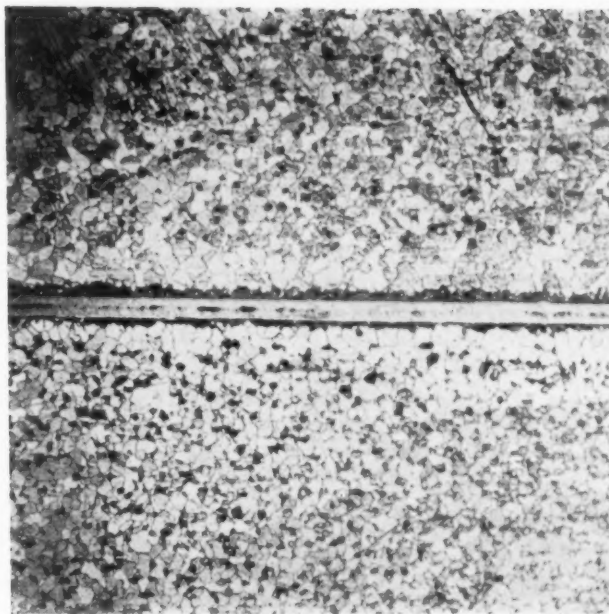


Fig. 3A. Heavy copper deposit showing light, uniform layer highly carburized. This is much more difficult to machine than the type shown in Fig. 3. Mag. 100x.

In all cases the actual checking for carbon penetration, after carburizing and hardening was done first with a microscope, and, second, by means of a Rockwell machine for superficial hardness using a 15 N scale.

Test Panels

With the idea in mind that thickness was of considerable importance, the first set of test panels varied from 0.0001" to 0.001" of copper plated from each of the following types of solutions:

1. 30 panels acid copper with cyanide copper strike,
2. 30 panels acid copper with nickel strike,
3. 33 panels bright alkaline copper, No. 1, and very thin cyanide strike,
4. 33 panels cyanide copper (conventional).

Deposits in each set were varied from 0.0001" and for each thickness the carburizing time was varied from two to twenty-four hours. The latter figure being far in excess of any normal carburizing time which usually reaches a maximum of about four hours.

After carburizing, all of the test plates were "hardened" by heat treatment in a cyanide bath at 1450° F. This hardening treatment consisted of leaving the parts in the bath (soaking) for five minutes after the parts reached the temperature of the bath.

Results of Tests

Of the 126 pieces in this set only eight were found showing serious carbon penetration, each of which had less than 0.0003" of copper deposited upon it. Of these eight pieces four were plated in an acid copper bath after a cyanide copper strike, two were plated in the bright alkaline copper bath No. 1 and two in the conventional cyanide bath. The

failure of these deposits in each case was traceable to pores or voids in the deposit. Figure II shows the effect of such deposits.

In no case could a relationship between copper thickness and carburizing time be established. Consequently the next group of panels were all carburized for six hours, which was still somewhat above the average for commercial work. This group was prepared as follows:

1. 10 panels, plated with Rochelle salt copper,
2. 10 panels, coated with cuprous oxide and "reduced" cuprous oxide,
3. 18 panels, bright acid copper No. 1 over a "cyanide strike,"
4. 10 panels, bright acid copper No. 2, one-half of which were plated over a cyanide strike and the balance over a bright copper strike,
5. 18 panels, bright alkaline copper No. 2,
6. 12 panels miscellaneous finishes, "Black Oxide," phosphate, copper-lead and copper-cadmium alloy deposits.

Based on the observations made in the previous group this set reacted much in the manner expected in that the only evidence of penetration was again traceable to voids in the deposits. In this respect, deposits from the Rochelle bath were not as good as the other baths in that some evidence of penetration in spots was found on each of the plates in this group.

The copper-lead and copper-cadmium alloy deposits reacted no differently than pure copper from a conventional cyanide bath.

Phosphate and "Black Oxide" coatings were useless as a means of preventing carburization.

There was no noticeable difference between the two bright acid coppers in this group and the bright alkaline nor were these an improvement over the straight cyanide deposits in the first group.

The cuprous oxide and "reduced" oxide coatings were with the exception of the "Black Oxide" the thinnest coatings tested. The straight oxide coatings were of the order of 0.00003" while the "reduced" coatings were approximately two-thirds that value.

There was some evidence of penetration through these coatings particularly on one panel, Figure III, which had been given an immersion coat of arsenic prior to plating with the oxide coating.

In no case was this penetration sufficiently serious to cause a marked change in hardness. These panels which ranged from Rockwell 53-60 before treatment ranged from 54 to 63 on the 15 N scale after treatment. This of course is not enough to notice in any ordinary machining operation.

The work on these coatings is being continued inasmuch as they have presented some interesting possibilities, such as the use of the oxide under conditions wherein the temperature is higher than that in which copper can be safely used.

From observations made during the preparation and checking of the test panels involved here we have concluded:

1. That the thickness of electrodeposited copper is not a function of its ability to withstand penetration by carbon monoxide except in so far as thickness is a factor in determining the freedom from porosity of the deposit.
2. The thickness of copper deposited from an acid copper bath will have to be greater than that deposited from a cyanide or bright bath in order to obtain the same protection, due to the apparent greater permeability of acid copper deposits.
3. With factors other than thickness disregarded, bright copper deposits offer little advantage over those obtained from a standard cyanide.

In closing, we wish to thank Dr. J. E. Stareck of United Chromium, Inc., W. M. Phillips, General Motors Research Division, and E. C. Friedl and H. A. Brenner of the Electroplating Division of E. I. du Pont de Nemours and Company for their kind cooperation in obtaining for us plated specimens which we were unable to finish in our own laboratory.

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Rectifiers For Electroplating

By R. W. WILLIAMS

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MOST of the world's electric power is generated and used in the form of alternating current. The principal reason for this is the simple manner in which the voltage can be stepped up or down by means of a transformer, thus resulting in more economical transmission of power.

There are, however, certain applications which work best with direct current (electroplating is one of these applications) and some device is necessary, therefore, to change the alternating current to direct current. This device is the rectifier.

Rectification Principle

Before delving further into the operation of rectifiers, some explanation should be made of alternating current and how it appears on an oscillograph—an instrument that can "X-ray" a circuit and show how it works.

The oscillograph is connected across a lamp which runs on a.c. and the shape of the wave shows up on the oscillograph screen as drawn in Fig. 1. To rectify this wave, it is necessary to cut off all portions of the wave that go below the zero line. This is where the rectifier enters the picture.

If we construct a circuit as shown in Fig. 2 and can arrange to open the switch "S" every time the wave goes below the zero line and close it when the wave goes above the line, we will obtain a curve as shown in Fig. 3. This current is now unidirectional.

A rectifier is similar to this switch "S" and will perform the same operation of blocking the wave below the zero line and allowing the other portion to go through. By combining several rectifiers in suitable circuits it is possible to make use of both sides of the waves and obtain the benefit of



Fig. 1. Wave form of alternating current as shown by the oscillograph.

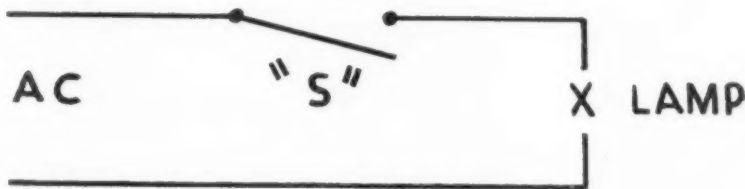


Fig. 2. Drawing of circuit to cut off reversal of wave form.



Fig. 3. Wave form obtained by shutting off reversal of current.



Fig. 4. Picture of wave form when full wave rectification is obtained.

full wave rectification as shown in Fig. 4.

Types of Rectifiers

In industrial work, four principal types of power rectifiers are used:

1. Mechanical rectifiers
2. Mercury arc rectifiers
3. Tube rectifiers
4. Metallic rectifiers

Mechanical Rectifiers

The familiar motor-generator set is a good example of the mechanical rectifier. This is a rugged, very reliable

piece of apparatus which is quite efficient at full load. It consists simply of an a.c. motor connected directly or through a belt to a d.c. generator. The voltage is controlled by a field rheostat. Because its construction involves rotating parts, a certain amount of maintenance is necessary.

The synchronous converter is another type of mechanical rectifier of the rotating type. It consists of a direct current generator which has slip rings as well as a commutator. The a.c. and d.c. go in and come out of the same winding and because of this the voltage output cannot be changed un-

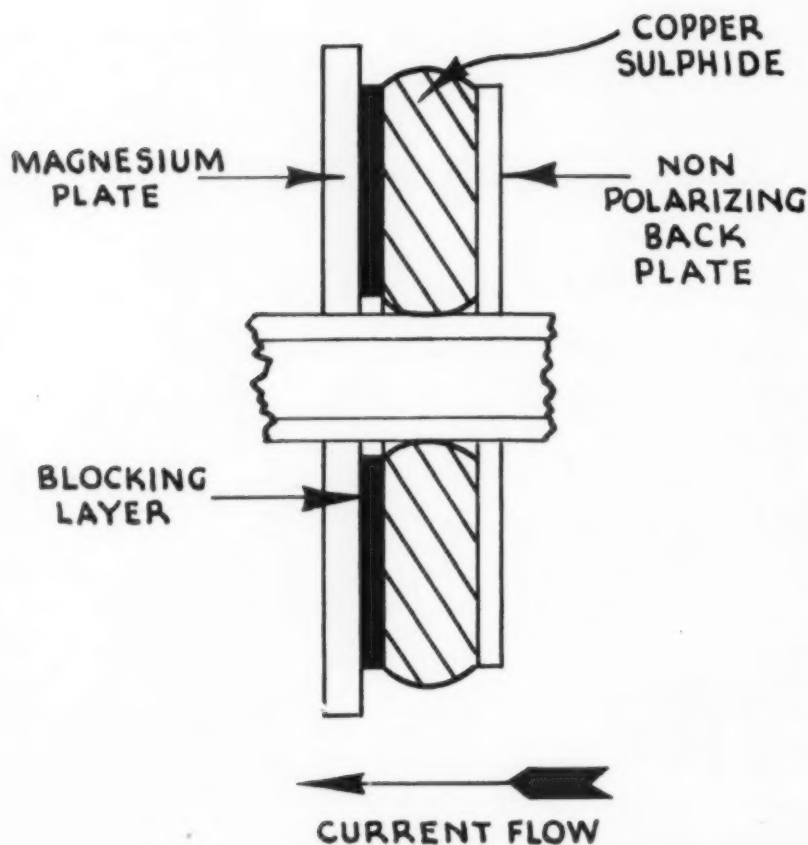


Fig. 5. Drawing illustrating the construction of a copper sulphide type rectifier plate.

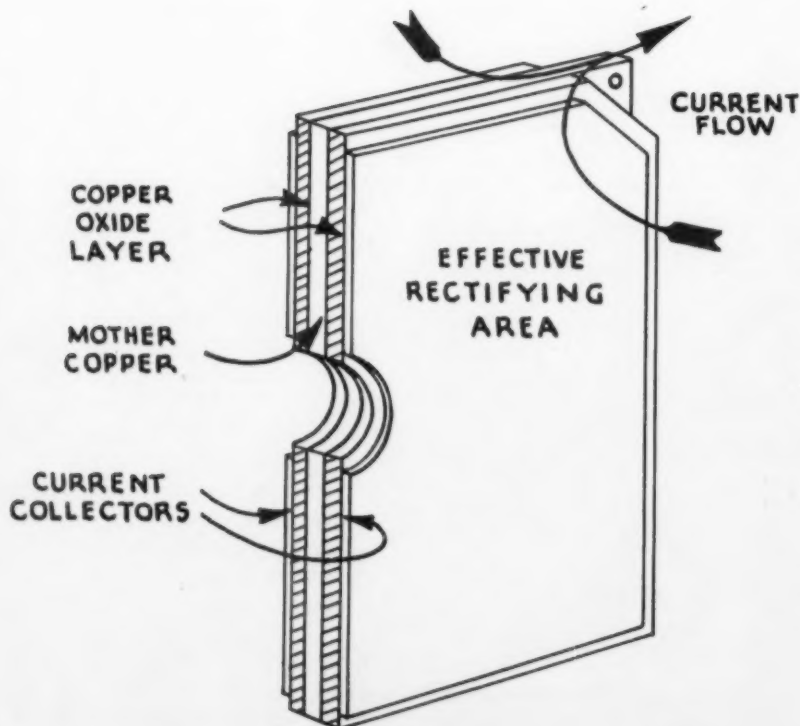


Fig. 6. Drawing illustrating the construction of a copper oxide type rectifier plate.

less the a.c. voltage is transformed up or down as required, by the use of transformers.

This type is not used in low voltage applications. It is very efficient and runs up to 95% in some cases.

Mercury Arc Rectifiers

This is another type of rectifier used in high power work where the voltage exceeds 50 volts. Below this voltage, mercury arc rectifiers are not satisfactory. Their efficiency is high, reaching 95%, and they are used primarily in railroad work, chemical plants, refineries and similar industrial applications.

Tube Rectifiers

The most common example of this type of rectifier is the tube in the ordinary radio set. In general, tube rectifiers operate on the principle of boiling electrons out of a hot filament. These are attracted to a plate whenever the polarity is positive and repelled when the polarity is negative.

In certain types of tube rectifiers, gas is admitted inside the tube to lower the resistance path between the plate and filament, thus allowing more current to flow. This gas is generally argon or mercury vapor. An example of this type of tube rectifier containing gas is the familiar "Tungar" tube used in "Tungar" battery chargers.

Metallic Rectifiers

There are three principal types of metallic rectifiers:

1. Copper sulphide rectifier
2. Copper oxide rectifier
3. Selenium rectifier

Copper Sulphide Rectifier

The copper sulphide rectifier has been commercialized more in the U. S. than elsewhere although it was invented in Austria. Essentially, this rectifier consists of three separate parts held together under pressure. By means of an electrochemical process, a film is formed between the magnesium and copper sulphide disc and this film appears to have the property of passing more current in one direction than in the other; i.e., from the copper sulphide to the magnesium. This is indicated by Fig. 5.

According to published information, the ratio of rectification is about 75 to 1; however, this type of rec-

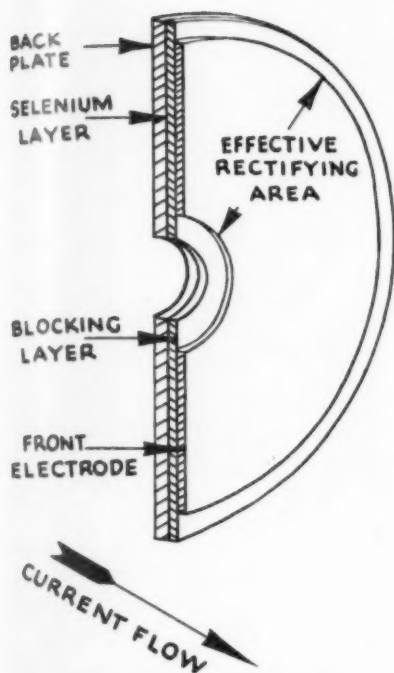


Fig. 7. Drawing illustrating the construction of a selenium type rectifier plate.

tifier must be thoroughly protected from absorbing moisture to insure a relatively longer life. Its efficiency when used on a 3-phase circuit is around 50% for the elements alone.

Copper Oxide Rectifier

This type of rectifier was invented in this country by Dr. Grondahl and has been commercialized both here and abroad.



Fig. 8. A commercial rectifier of a copper oxide type with a rating of 500 amperes at 6 volts.

It consists of a copper plate oxidized at a high temperature so as to form a layer of red cuprous oxide which gradually forms into one integral piece. Current passes more readily from the layer of oxide to the copper, and rectification ratios of 5000 to 1 have been obtained on commercial cells. For a drawing of this type, see Fig. 6.

The copper oxide rectifier has been in use for many years, and rectifiers of this type appear to have an indefinite life. Their efficiency, when used on 3-phase circuits, is between 75% and 85% depending upon the voltage and circuit used.

Selenium Rectifier

The selenium type rectifier is a much more recent type. In construction it consists of 3 primary elements. A backplate supports a thin fused layer of selenium which in turn is covered with a layer of sprayed metal known as the "counter electrode". For illustration of this, see Fig. 7.

Between the counter electrode and the selenium, a blocking layer of film is formed by means of an electrochemical process. It is this layer that acts as a one-way path for the flow of the current from the selenium to the sprayed layer.

Recent tests on domestic cells indicate that their life expectancy is good. Their efficiency, when used on 3-phase circuits, is between 75% and 85% depending upon the voltage and circuit used.

Electroplating Rectifiers

An electroplating rectifier consists essentially of a voltage regulator, a step-down transformer, and the rectifier elements. It makes no difference whether the elements are copper oxide, selenium or copper sulphide, inasmuch as the same principles are involved.

Fig. 8 illustrates a copper oxide rectifier. It is constructed in a compact casing and has a rating of 500 amperes at six volts. It is built to permit tier mounting. The inside construction is shown in Fig. 9. Here is seen the transformers, the rectifier units and the cooling fan. Fig. 10 shows an enlarged view of one of the rectifier units.

Fig. 11 illustrates a typical voltage



Fig. 9. Inside construction of a copper oxide type rectifier as shown in Fig. 8. The transformers, the rectifier units and the cooling fan can be seen.

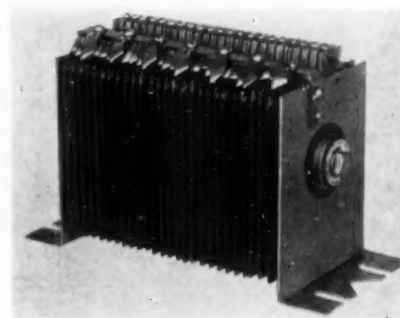


Fig. 10. Enlarged view of one of the rectifier units.

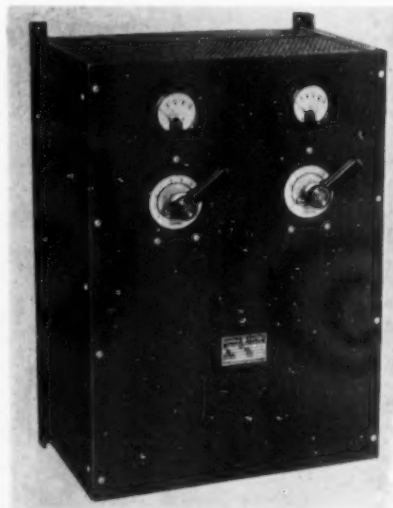


Fig. 11. A typical voltage regulator.

regulator which is used ahead of the rectifier assembly to permit easy control of the voltage and the current output. The action of this is similar in effect to the tank rheostat except that it works on the transformer principle and not the resistance drop method as is the case with the rheostat.

The use of an external controller permits grouping rectifiers in series-multiple to obtain all types of combinations as required by the particular plating tank in use.

Rectifier Efficiency

Naturally, the efficiency of rectifiers varies with each type. In Fig. 12, we have attempted to show the effect of this rate of efficiency on the production of useful work. The white rectangles represent \$100 of power used in the plating tank to produce useful work. The black rectangles show the wasted power in dollars. Needless to say, as the efficiency of a unit decreases, the amount of wasted power greatly increases.

Some plating shops follow the practice of installing a large motor generator set as a source of d.c. with bus bars connected between the source of d.c. and the various tanks as shown in Fig. 13. Each tank is supplied with a tank rheostat to permit control of the current used in the plating operation. The generator voltage is usually held constant and the voltage regulation is the best.

This method, however, can be less efficient than the rectifier method as demonstrated by the following examples.

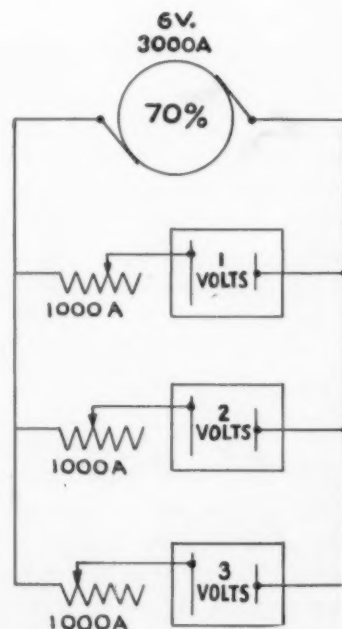
If we assume that the motor generator set in Fig. 13 is 70% efficient and its full load capacity is 6 volts at 3000 amperes or 18 kw., the power

input is $\frac{18 \times 100}{70}$ or 25.7 kw. at

unity power factor. The useful power is figured as follows:

1 v. x 1000 or 1000 watts
2 v. x 1000 or 2000 watts
3 v. x 1000 or 3000 watts
which adds up to 6 kw. To use 6 kw. of plating power, we use 25.7 kw. of current and the efficiency is only 23.3%. At \$.05 per kw., the cost is approximately \$1.25.

Now—by replacing the single source of supply with three separate sources as shown in Fig. 14, we increase the plant efficiency substantially. Assum-



ing that copper oxide rectifiers are installed with separate voltage regulators and they are adjusted at 1, 2, and 3 volts and 1000 amperes, the following efficiency is obtained.

Tank No. 1 will operate at 40% efficiency

Tank No. 2 will operate at 53% efficiency

Tank No. 3 will operate at 61% efficiency

The average efficiency is the sum of

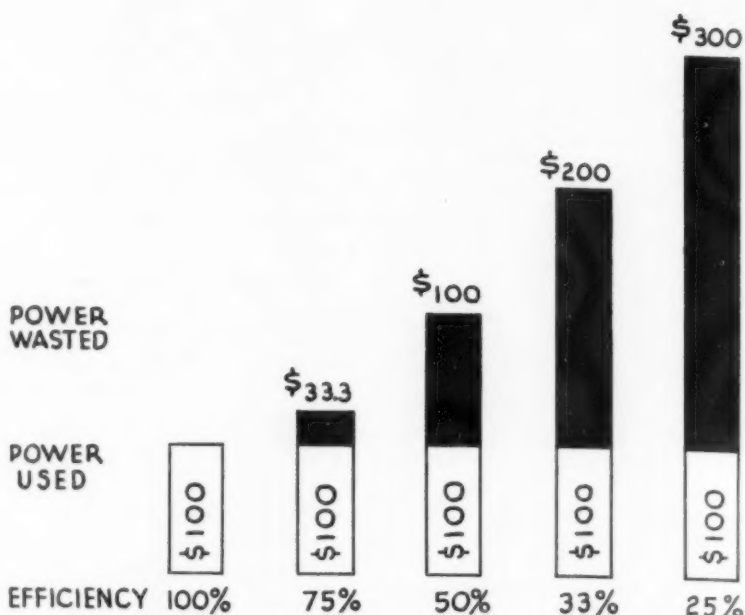


Fig. 12. Chart showing the relative power wasted and the power used for various efficiencies of the power unit.

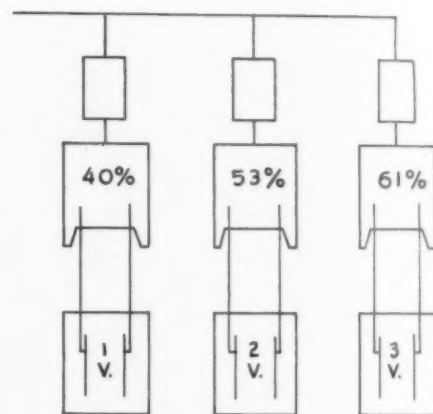


Fig. 14. Drawing illustrating efficiencies obtained by separate power sources for each tank.

Fig. 13 (left). Drawing illustrating a common arrangement of the electrical circuit with one power source and three tanks.

the above divided by three or 51.3%. Since we are still using 6 kw. of useful power and the power input is 6×100

— or 11.6 kw. (assuming unity 51.3 power factor), at \$.05 per kw. the cost is approximately \$.55.

For most applications, therefore, the recommended rectifier method will prove much more efficient than the single source of supply method.

Zinc Losses in Hot-Dip Galvanizing

There Is No Evaporation of Zinc in Hot-Dip Galvanizing

By WALLACE G. IMHOFF

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ALL hot-dip galvanizing companies are confronted with the fact that they are rarely ever able to account for all of the metal used in hot-dip galvanizing. Some years ago this very important question came up for discussion among a large group of galvanizers and some very startling facts were revealed. First, all agreed that it was impossible to account for every pound of zinc purchased; second, it was stated by many of them, "that the zinc simply evaporated"; and third, this "evaporation loss" was found to vary from a few per cent to as high as 15% of the metal purchased. It simply could not be accounted for, so most of them just assumed that it evaporated from the galvanizing pot during galvanizing operations. Finally it was definitely decided to find out what became of this zinc that could not be accounted for, whether it did evaporate, or where it went to if it did not evaporate.

A Metal Balance the Answer

Since there are many different variables involved in attempting to accurately account for all of the metal put into a galvanizing pot, the only answer that could have any value is to make a metal balance sheet of all the metals put into the galvanizing pot, and then trace in a scientific manner and account for where every pound of metal went to that came out of the galvanizing pot. To the layman such a task might seem quite simple, but in reality it is extremely complicated and involves not only a knowledge of practical galvanizing operations, but also must take into consideration such outside components as the accuracy of the chemical analyses of the by-products and scales used in weighing the materials and the human factor as well.

If 100,000 pounds of metal are put into the pot, then such a metal balance must account for 100,000 pounds of metal taken out of the pot and dispersed in the various ways that it disappears, in and during galvanizing operations. The most important items of metal dispersement are as zinc coating on the product, and into the by-products—dross and sal-ammoniac and oxide skimmings. There are many other items of a concealed nature that may or may not use up zinc that has been assumed to have evaporated.

A Few Physical and Chemical Properties of Zinc

It would be useless to give a long detailed account of the physical and chemical properties of zinc. However, in order to clearly show that the metal zinc does not evaporate, a few of the properties will be valuable for reference. Zinc is not the only metal put into the galvanizing pot. Aluminum, iron, cadmium, tin, lead, and antimony are generally present to a greater or less degree. These metals must also be taken into consideration and ac-



Fig. 1. Metal ware galvanizing. Note the careful poise taken by the operator in withdrawing the tub from the galvanizing bath. The care in handling affects the weight of the zinc deposited.
(Courtesy of The National Enameling & Stamping Co., Milwaukee, Wisconsin).

counted for in making a metal balance sheet. A few of the properties of these metals are given in the following table.

TABLE I

Metal	Melting Point °C.	Melting Point °F.	Boiling Point °C.	Boiling Point °F.
Zinc	419.4	786	905.2	1661
Iron	1530.0	2786	3000	5432
Aluminum	658.7	1217	1800	3272
Tin	231.9	450	2260	4100
Cadmium	320.9	609.6	767	1412
Lead	327.4	621.3	1620	2945
Antimony	630.0	1166.0	1440	2624

Hot-dip galvanizing bath temperatures under operating conditions average from 840 to 860 degrees F., with some baths going as high as perhaps 880° F. The danger limit is 900° F. Thus, if we look at the last column shown in Table I, we see that the boiling points for all of the metals used in galvanizing operations are far above 900° F. which is the danger high limit for the galvanizing bath temperature.

Boiling Point and Oxidation

The boiling point of zinc is shown to be 1661° F. There is rapid vaporization at the boiling point of all substances. For example, water may vaporize slowly without boiling, but at the boiling point it vaporizes rapidly.

It has been found that the iron content of the galvanizing bath causes it to oxidize rapidly at 1100° F., although it is a practical operating fact that the zinc slowly oxidizes at galvanizing bath temperatures. Even as low as 800° F., iron in the zinc bath increases its tendency to oxidize and form an oxide scum over the surface. These points are all brought out to show up more clearly the metal balance sheets which follow later on in the discussion.

Factors Involved in a Metal Balance

To really get some idea as to the many variables involved in trying to obtain a metal balance sheet, a very brief word will be said about each of them.

First, there is the zinc used for the actual galvanized coating.

Second, there is the zinc which goes into the dross, the sal-ammoniac skimmings, and the oxide skimmings.

Third, there is the variable of getting accurate average samples of each one of these by-products.

Fourth, there is the variable in mak-

TABLE II
LABORATORY TEST FOR EVAPORATION LOSS

PUT IN	800° F.	800° F.	820° F.	840° F.	860° F.	880° F.
(a) Kettle	277.00 lb.	260.00 lb.	264.00 lb.	271.5 lb.	266.5 lb.	264.5 lb.
(b) Dried P. sheets	18.14 "			18.28 "		
(c) Zinc	749.00 "	778.00 "	755.50 "	720.00 "	749.25 "	746.75 "
(d) Sal-ammon.	3.00 "	1.00 "	.25 "	1.00 "	.25 "	1.00 "
(e) Flux box	1.25 "	.75 "	1.50 "	1.75 "	1.75 "	1.50 "
Total (1)	1048.39 "	1039.75 "	1021.25 "	1012.53 "	1017.75 "	1013.75 "
TAKEN OUT						
(a) Kettle	271.50 "	264.00 "	266.50 "	270.00 "	264.50 "	267.00 "
(b) Dried P. sheets	18.14 "			18.28 "		
(c) Zinc	727.50 "	633.00 "	646.25 "	525.00 "	661.25 "	668.75 "
(d) Flux box	1.75 "	1.50 "	1.75 "	1.56 "	1.50 "	1.70 "
(e) Zinc coat	4.39 "	5.55 "	5.37 "	4.44 "	5.45 "	5.11 "
(f) By-products:						
1. Dross	8.50 "	104.75 "	90.50 "	186.00 "	68.50 "	62.25 "
2. Sal-skim	1.00 "	2.50 "	0.00 "	.50 "	0.00 "	1.00 "
Oxide skim	23.50 "	25.00 "	17.00 "	25.00 "	18.00 "	12.25 "
Total (2)	1056.28 "	1036.30 "	1027.37 "	1030.78 "	1019.20 "	1018.06 "
Total (1)	1048.39 "	1039.75 "	1021.25 "	1012.53 "	1017.75 "	1013.75 "
Difference	7.89 "	3.45 "	6.12 "	18.24 "	1.45 "	4.31 "
	Gain	Loss	Gain	Gain	Gain	Gain

TABLE III

LABORATORY TEST—METAL BALANCE SHEET

PUT IN	800° F.	800° F.	820° F.	840° F.	860° F.	880° F.
(a) Kettle	277.00 lb.	260.00 lb.	264.00 lb.	271.50 lb.	266.50 lb.	264.50 lb.
(b) Zinc	749.00 "	778.00 "	755.50 "	720.00 "	749.25 "	746.75 "
(1) Total	1026.00 "	1038.00 "	1019.50 "	991.50 "	1015.75 "	1011.25 "
TAKEN OUT						
(a) Kettle	271.50 "	264.00 "	266.50 "	270.00 "	264.50 "	267.00 "
(b) Zinc	727.50 "	633.00 "	646.25 "	525.00 "	661.25 "	668.75 "
(c) Oxide skim	17.86 "	19.94 "	13.60 "	19.00 "	14.40 "	9.80 "
Sal-skim	.60 "	1.32 "		.30 "		.50 "
Dross	8.00 "	99.45 "	85.97 "	174.84 "	65.08 "	58.24 "
(d) Zinc on flux box	.50 "	.75 "	.25 "			.20 "
(e) Zinc on thermometer	.25 "	0.00 "	0.00 "	0.00 "	0.00 "	0.00 "
(f) Zinc on sheets	4.39 "	5.55 "	5.37 "	4.44 "	5.45 "	5.11 "
(2) Total	1030.60 "	1025.01 "	1017.94 "	993.58 "	1010.68 "	1009.60 "
(1) Total	1026.00 "	1038.00 "	1019.50 "	991.50 "	1015.75 "	1011.25 "
Difference	4.60 "	13.99 "	1.56 "	2.08 "	5.07 "	1.65 "
	Gain	Loss	Loss	Gain	Loss	Loss

TABLE IV

	Kettle #4	#6
Zinc in kettle at beginning of test	23,418 lb.	32,278 lb.
Zinc put into kettle during two weeks	19,761 "	26,801 "
Zinc in kettle at end of test	23,418 "	32,278 "
By-products made during test:		
Dross	1,602 "	1,792 "
Sal-ammoniac skimmings	1,135 "	1,765 "
Oxide skimmings	987 "	1,370 "
Metal on goods	16,791.96 "	22,260.48 "

METAL BALANCE

	#4	#6
Zinc put into kettle	19,761 lb.	26,801 lb.
Zinc taken out—		
Dross—1602 x .96	1,537.92 "	1,720.32 "
Sal-ammoniac skimmings—1135 x .60	681.00 "	1,059.00 "
Oxide skimmings—987 x .76	750.12 "	1,041.20 "
Metal in kettle	19,761.00 "	26,081.00 "
Metal in by-products	2,969.04 "	3,820.52 "
Metal on goods	16,791.96 "	22,260.48 "

ing accurate chemical analyses of these by-products. Considerable errors have been shown to have occurred in both sampling and analyses.

Fifth, all zinc contains some oxide, scurf, and dirt in it which is seldom taken into account.

Sixth, considerable errors have been found due to inaccuracy of the scales on which the zinc is weighed.

Seventh, a very large apparent zinc loss can occur when black weights are used instead of pickled weights for calculating the amount of zinc used for coating purposes.

Eighth, there are metallic losses on the floors, walls, and in water quench tanks, etc.

Ninth, metal is lost in stripping, burning off coatings, etc.

Tenth, there are metal losses and inaccuracies of metal accounting at the time of pot failures.

Eleventh, zinc is alloyed to the pot sides and to work lost in the galvanizing bath; the latter is sold as scrap.

Twelfth, there are variations in standard accepted coating weights due to different galvanizing bath temperatures, or to different gauges of base metal, or to different kinds of base metal. These represent the most important places that must be studied and checked into when making an accurate metal balance sheet.

Comments on Laboratory Tests

The many different places where errors can creep in and make it difficult to account for every pound of metal used have already been cited. In the laboratory tests, even the galvanizing pot itself was removed with each test and weighed, even though it held about 800 pounds of metal. Even the tools were weighed before and after each test, and the flux box was removed and weighed also. Ten sample sheets were averaged as a single reading and many different gauge sheets were galvanized in each test and at each temperature. The sheets were weighed before and after pickling, and also after galvanizing. Every pound of dross, sal-ammoniac skimmings, and oxide skimmings was carefully saved and weighed in each test at each temperature. Then the average samples were carefully analyzed. The entire set of tests was conducted under the most scientific conditions possible, with a careful check-up being made that no materials were lost.

The figures obtained from all operations and weighings, etc. are shown in Table II. This table shows the actual materials with their weights. It will be noted that there is a gain in every case except the one test at 800° F. which shows a small loss. In Table III, everything has been reduced to a metallic value for the metal balance. The actual gains and losses are so small that the error, or difference, could almost be obtained in the hundreds of weighings involved alone. The complete list of where errors can occur shows many places, but for all practical purposes it can be stated that there certainly has been no loss of metal due to evaporation.

An Approximate Check of the Metal on the Goods (Zinc Coating)

Results of tests on two large, full-sized galvanizing kettles. The tests were made over a period of two weeks time.

It might be mentioned that an average galvanizer's dross will carry about 96% zinc and about 4% iron; some go slightly lower in iron and higher in zinc content. An average sal-ammoniac skimming will carry about 60% of zinc. Here again there is considerable variation according to the metallics carry-out by individual operating practice. The average oxide skimming will carry about 76% of metal. This too

TABLE V
GENERAL BALANCE SHEET

	Test A	Test B
1. PUT INTO KETTLE:		
(a) Zinc	10,807.00 lb.	9,739.00 lb.
(b) Tin	4.00 "	3.50 "
(c) Aluminum	5.00 "	5.00 "
(d) Sal-ammoniac (for flux)	331.00 "	312.00 "
(e) Sal-ammoniac (zinc ashes)	68.00 "	42.00 "
(f) Middlings	4.25 "	2.50 "
Total (1)	11,219.25 "	10,104.00 "
2. TAKEN OUT OF KETTLE:		
(a) Dross	1,033.00 lb.	1,122.00 lb.
(b) Zinc ashes	626.00 "	585.50 "
(c) Sal-ammoniac skimmings	901.00 "	893.00 "
(d) Zinc on articles	8,770.67 "	7,438.49 "
Total (2)	11,330.67 "	10,038.99 "
Total (1)	11,219.25 "	10,104.00 "
	Gain 111.42 "	Loss 66.01 "

NOTE: Under (1)—(d) The sal-ammoniac is used for making up the flux.

Under (1)—(e) This sal-ammoniac is used for burning and melting the metallics out of the oxide skimmings.

TABLE VI
METAL BALANCE SHEET

	Test A	Test B
1. PUT INTO KETTLE:		
(a) Zinc	10,807.00 lb.	9,739.00 lb.
(b) Tin	4.00 "	3.50 "
(c) Aluminum	5.00 "	5.00 "
Total (1)	10,816.00 "	9,747.50 "
2. TAKEN OUT OF KETTLE:		
(a) Zinc, Aluminum, Tin	0000.00 lb.	0000.00 lb.
(b) Dross—1033 at 95.827%; 1122 at 96.283%	989.89 "	1,080.29 "
(c) Zinc ashes—626 lb. at 76%	475.76 "	444.98 "
(d) Sal-ammoniac skimmings—901 lb. at 60%	540.60 "	535.80 "
(e) Zinc on articles	8,770.67 "	7,438.49 "
Total (2)	10,776.92 "	9,499.56 "
Total (1)	10,816.00 "	9,747.50 "
	Loss 39.08 "	247.94 "
Per cent loss	0.36%	2.54%

NOTE: In Test B it was extremely difficult to obtain absolutely exact records due to the many variations and changes made on the kettle. This no doubt was the cause of the slightly higher loss figure.

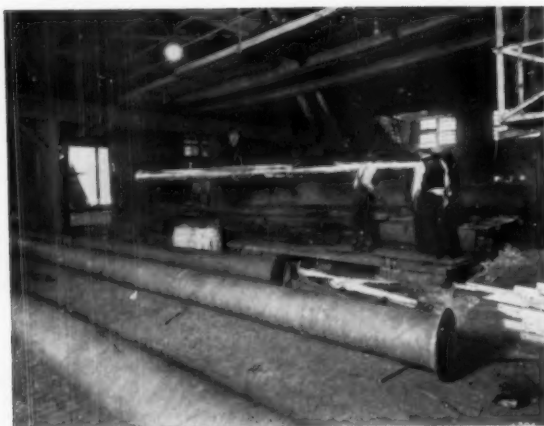


Fig. 2. Hot-dip galvanizing large articles.
(Courtesy of International-Stacey Corporation, Columbus, Ohio).

varies from plant to plant but all of the above percentages may be used as average values for rough figuring purposes and metal check-up.

Evaporation Losses of 2 to 15% Cited

Up to the time of making these laboratory and practical operating tests to check-up on metal losses, termed by many companies as "evaporation losses," some companies had reported as high as 15% "evaporation loss." Others varied between 5 and 10%, but all agreed and seemed positive that there was an actual "evaporation loss" of metal. Even the tests made were not enough to make some believe that there were not "evaporation losses."

In order to satisfy even the most skeptical, the writer took a full-sized galvanizing kettle operating in one company's plant under routine production along with five other kettles all on the same class of articles—namely, metal ware, such as standard water pails, wash tubs of all sizes, ash cans, garbage cans, cement pails, and all of the regular routine line of metal ware articles.

One kettle was set aside in a battery of six, and every item of production, every slab of metal, in fact, everything of every kind was weighed before and after galvanizing in this kettle. Samples of the by-products were carefully selected; all scales were tested, and everything was reduced to the scientific state on a full-sized plant scale under normal operating production along with the five other kettles. One-sixth of every group of articles was sent to the test kettle in routine operations covering the full period of

one month. The metal line was marked at the start, and the pot filled up to the line at the finish. The results of the tests are given in Table V.

Summary

Inasmuch as hot-dip galvanizing operations are carried out far below the boiling point of zinc, the theory that heavy zinc losses have been due to evaporation of the metal are not substantiated by facts as obtained by careful laboratory and practical plant tests. Any discrepancies between actual amounts of zinc put into the galvanizing kettle and the total amount of metal accounted for after galvanizing seem to be due to a number of concealed causes. The most important of these concealed causes are:

1. The metal purchased is not all metallic zinc. The amount of oxide scurf and dirt in it varies from 0.5 to as high as 2.00%.
2. Varying amounts of zinc go into the by-products dross, sal-ammoniac skimmings, and oxide skimmings. It is extremely difficult to obtain average samples of these materials that give a very close metal content for all times, all conditions, and all products, in each field of galvanizing.
3. Very considerable errors have been found in checking up the chemical analyses of these by-products, submitted from various chemical laboratories.
4. Some companies base their figures for coating weights on black weights. Scale weights and thicknesses vary widely on different classes of articles, and this can introduce a very large error of zinc used for coating purposes.

5. The number of errors must be in direct proportion to the number of weighings and the different operations which involve accounting for the zinc.

6. Scales are not always carefully checked for accuracy. Errors of only a fraction of a pound become very large errors when they accumulate.

7. Considerable amount of zinc can remain unaccounted for by carelessly allowing the metal to remain unswept from the floors, or to be spattered over the walls and ceiling, or if an account is not taken of the shot, drippings, etc. that go into water quench tanks.

8. In some fields of galvanizing, such as pole-line hardware, a very large amount of material may be lost to the bottom of the pot. When the pot is drossed, this is usually fished out and in most cases this lost material is covered with a heavy coating of zinc-iron alloy. This can be a very large source of zinc which is unaccounted for if no record is kept of the metal taken on by this scrap.

9. An especially large source of metal loss is involved in the handling of the metal at the time a pot fails. Unless a good systematic method is used for getting the metal out of the pot, handling the molten metal, and finally for getting the last metal out of the pot, a very considerable metal loss can occur at this time.

10. A definite metal line is not always established on the pot so that when such a metal balance is sought, the same amount of metal will always be in the pot, and any loss or gain of zinc in the pot will be eliminated.

It has been definitely proven that the weight of zinc deposited is a direct function of galvanizing bath temperature, submersion time, gauge of base metal, kind of base metal, speed of production, kind of article, and method of handling. If a metal balance is to be obtained accurately, there must be a standard galvanizing practice so that the conditions for each class of articles will always be approximately the same. If this is not done, more or less zinc may be deposited as galvanized coating due to the varying pickling and galvanizing conditions.

Conclusion: Both laboratory tests and practical plant tests indicate that there is no evaporation of zinc as a result of hot-dip galvanizing operations. When galvanizing operations are carefully and scientifically carried out, all of the metal used can be accounted for.

ABSTRACTS OF TECHNICAL PAPERS

Presented at

Fall Meeting of Electrochemical Society

THE CORROSION RESISTANCE AFFORDED BY BRIGHT DIPPED CADMIUM COATINGS

By GUSTAF SODERBERG

Outdoor exposure tests in a highly corrosive industrial atmosphere have shown that the normal use of a chromic acid bright dip, which removes 0.00022 mm. (0.000009 in.) or less of plate, has no adverse effect on the corrosion resistance afforded by cadmium coatings more than 0.0025 mm. (0.0001 in.) thick and that a definite improvement in corrosion resistance after this treatment has been found at a thickness of 0.0075 mm. (0.0003 in.). This beneficial effect is not expected from bright dips which do not strongly passivate the surface.

TIN PLATING FROM THE POTASSIUM STANNATE BATH

By MARTIN M. STERNFELS AND FREDERICK A. LOWENHEIM

Characteristics of the potassium stannate-potassium hydroxide system are described, and its applications to tin plating are outlined. The effect of variations in bath composition and in operating conditions upon plating characteristics is traced. Because of much higher solubility and favorable solubility vs. temperature relationships, as well as higher conductivity, and a wider range of useful current densities, the potassium stannate bath has many advantages over the conventional alkaline bath. Possible fields of application are indicated, with special reference to the electroplating of steel strip.

HIGH-SPEED ANALYSIS AND CONTROL OF PLATING SOLUTIONS

By GEORGE JERNSTEDT

By use of various rapid methods, analysis time for plating solutions was reduced from one-tenth to one-half the original, while at the same time preserving the required accuracy. The use of the centrifuge for analysis of carbonate and free cyanide was investigated. The spectrophotometer was employed to analyze nickel plating solutions. Rapid methods for the control of plating solutions by routine additions were shown, and a circular slide rule was developed for routine calculations. Analysis reports were standardized and made to record analytical data, additions made, the time additions made, and remarks on solution operation.

CATHODE FILMS IN TUNGSTATE-CONTAINING PLATING BATHS

By M. L. NIELSEN AND M. L. HOLT

Evidence for the presence of a cathode film formed by electrolysis of an acid tungstate solution is presented. This film, transferred with the cathode to a nickel plating bath, was found to prevent deposition of nickel, the current being dissipated in liberation of hydrogen. It was found that the film was removed from the cathode by immersion in alkaline solutions and in an oxidizing solution. It is believed that this cathode film operates with varying degrees of effectiveness in an acid bath used for plating nickel-tungsten alloys, and accounts for the type of deposits obtained. A mechanism is proposed to explain the codeposition of tungsten with nickel and other metals.

DIFFUSION THEORY OF THE CODEPOSITION OF GOLD AND COPPER

By MALCOLM DOLE

Factors influencing the composition of electroplated alloys are discussed. Data of Zvolner on the composition of gold-copper alloys are critically examined and interpreted in the light of relative rates of diffusion and ionization of the complex ions involved. The role of diffusion is stressed as this factor seems to have been largely overlooked, but it also appears to be necessary to take into consideration the rate of ionization of the copper complex cyanide ion in order to explain the composition of the alloys.

THE ELECTRODEPOSITION OF HARD NICKEL

By W. A. WESLEY AND E. J. ROEHL

Nickel deposits of a hardness of 380 to 480 Vickers can be produced in thickness and quality suited to industrial and engineering applications by use of electrolytes containing ammonium salts. It is shown experimentally that the soundness and structure of such deposits are markedly influenced by the composition of the plating bath in respect to other ingredients. Important improvement in the quality of the product can be accomplished by replacing the old hard baths with one of the following composition: nickel sulfate, $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$, 180 g./L.; ammonium chloride, NH_4Cl , 25 g./L.; boric acid, H_3BO_3 , 30 g./L. This electrolyte is well buffered, contains sufficient chloride to insure high anode efficiency, hence can be easily maintained at a constant pH. The hardness of deposits made from it varies but little with change in thickness and can be easily maintained by control of the plating conditions. Heavy deposits can be made which are free from laminations, sound in structure, of a high degree of hardness and tensile strength coupled with measurable ductility. Typical tensile properties of hard nickel are an ultimate strength of 157,000 lb./sq. in. (11,000 kg./cm.²) and an elongation of 6% in a gauge length of 2 in. (51 mm.).

ELECTRODEPOSITION OF NICKEL-TUNGSTEN ALLOYS FROM AN ACID PLATING BATH

By M. L. HOLT AND M. L. NIELSEN

Nickel-tungsten alloys have been electrodeposited from the Watts type nickel plating bath which was modified by the addition of small amounts of sodium tungstate. Alloy composition and current efficiencies were studied at various cathode current densities, bath pH's and bath temperatures. Many of the cathode deposits obtained were non-metallic in appearance and in some cases did not adhere to the basis metal; however, other deposits were metallic in appearance, smooth, adherent and readily buffed to a high polish. These metallic deposits contained from 5 to 10% of tungsten and were obtained only when conditions of electrolysis were carefully controlled. For purposes of comparison, the effect of the various electrolysis conditions on the current efficiency of the nickel plating bath (without tungstate) was also studied.

THE ADHERENCE OF THICK SILVER PLATE ON STEEL. II.

By H. LANCE CROSBY AND L. I. GILBERTSON

Photomicrographic examination of silver electrodeposited on steel indicates that the adherence of silver to steel is dependent on factors other than mechanical interlocking. Evidence indicates that the strike produces crystal nuclei at the edges of ferrite crystals and that the columnar, usually twinned, crystals which are plated on silver-struck steel grow from these nuclei. It appears that the most important factor in the bond between silver and steel is the intratomic bond between closely associated crystals of ferrite and silver and that this condition is favored by the use of a silver strike before plating. Previous reports that a strike is essential to the best adherence are confirmed.

THE STRUCTURE OF BRUSH-PLATED SILVER

By H. LANCE CROSBY AND L. I. GILBERTSON

The deposition of silver by means of a brush electrode and a paste type electrolyte results in a lamellar, microcrystalline deposit. The low porosity of these deposits may be the result of the lack of channels through the deposit to the basis metal.

STUDIES ON OVERVOLTAGE. XIII DECAY OF CATHODE POTENTIAL IN STILL AND STIRRED SOLUTIONS SATURATED WITH HYDROGEN OR WITH NITROGEN

By A. L. FERGUSON AND MYRON B. TOWNS

This is a continuation of studies on overvoltage. Attention is confined here to the natural decay on open circuit of cathode potentials at platinized platinum electrodes. Four factors were altered: first, a still solution saturated with hydrogen was used; second, a stirred solution saturated with hydrogen; third, a still solution saturated with nitrogen; and fourth, a stirred solution saturated with nitrogen. The object in each case was to produce a condition that would influence the rate of diffusion of active material away from the electrode solution interface. Previous experiments had indicated that cathode polarization potentials are determined by the activity of atomic hydrogen and hydrogen ions at the electrode-solution interface. The work was designed to provide information on this theory. All of the data obtained support the theory.

AN INTERPRETATION OF THE MECHANISM OF BRIGHT ELECTROPLATING

By JOHN A. HENRICKS

Previous theories on the behavior of brighteners are reviewed, and a new interpretation of the phenomenon is given in the light of the more recent developments in bright plating. The possible brightening mechanisms of commercially successful bright zinc, bright cadmium, and bright nickel baths are considered. A truly bright deposit is defined as one in which the specular reflection of the plate is superior to the specular reflection of the basis metal. A theory is proposed which states that when bright deposits are obtained by the use of organic addition agents, the brightness is brought about by the action of an adsorbed organic material of the acid inhibitor type which may be formed by cathodic reduction and which may be a colloid, working in conjunction with an inorganic colloid, the latter being a precipitated metal salt. This theory is extended to interpret the action of several less potent brighteners in various baths that appear in the literature.

SOME OBSERVATIONS ON THE FORMATION AND STABILITY OF OXIDE FILMS

By EARL A. GULBRANSEN

The existence, formation and stability of oxide films on iron, stainless steel and chrome iron are studied using a vacuum micro-balance technic. A low temperature hydrogen reduction technic is developed and used to study oxide film formed under a wide variety of experimental conditions. Using these technics the air film formed on a specimen of polished, annealed, pure electrolytic iron is shown to weigh 0.44×10^{-6} g. per cm^2 which corresponds to a theoretical film thickness of 29 Å. A similar specimen of passive iron is shown to have a film weighing 1.16×10^{-6} g. per cm^2 or 78 Å. Clean, degassed electrolytic iron is shown to react readily with oxygen at room temperature and at pressures as low as 10^{-6} atmosphere O_2 and with water vapor. At 800°C . oxygen is shown to react with iron at pressures as low as 3.3×10^{-7} atm. Preliminary oxidation curves of stainless steel chrome iron and pure iron are presented and discussed. The behavior of chrome iron and stainless steel in a vacuum of 5×10^{-6} mm. Hg at 600°C . and in hydrogen atmospheres at 600°C . and 800°C . is discussed.

AN ELECTROLYTIC STUDY OF LINEAR DIFFUSION OF SILVER SALTS

By H. A. LAITINEN

The theory of diffusion is applied to the case of a single metal salt undergoing electroreduction to the metal, with the diffusion process occurring in a linear column and assuming virtually complete concentration polarization of the cathode. The theoretical current-time relationship is applied to the diffusion of silver nitrate, silver acetate and silver sulfate and compared with experimental data. A comparison is made between the diffusion of pure silver salt solutions and the diffusion of silver ions in the presence of an excess of an indifferent ionized salt. The effect of an indifferent salt is shown to be analogous to the suppression of the migration current in polarographic current-voltage curves.

ION-SOLVENT INTERACTION AND INDIVIDUAL PROPERTIES OF ELECTROLYTES

By KASIMIR FAJANS AND OLIVER JOHNSON

1. The experimental data concerning the individual behavior of monovalent electrolytes in respect to concentration dependence of osmotic coefficients, apparent molar refraction and apparent molar volume are discussed from the point of view of the structure of ions and of the solvent water. 2. New support is given to the conclusion that refractometric data show the existence in aqueous solutions of strong electrolytes of combinations of oppositely charged ions without water molecules between them. 3. The distinction between: (a) an undissociated molecule of a weak acid in which the proton penetrates deeply into the electronic shell of the anion; (b) a complex ion (e.g., CdCl_4^{2-}) in which the electronic shells are considerably deformed; (c) an associated ion-pair of a strong electrolyte with a limited interpenetration and deformation of the electronic shells, is that of degree, not of principle. 4. Among the factors which are responsible for the individual behavior of strong electrolytes in aqueous solution, the following two are especially emphasized in this paper. The first factor is considered to be the resultant of the forces between neighboring ions and the forces between ions and the solvent; it is clearly responsible for the ease with which ions can be separated by the solvent molecules from a crystal lattice. The influence of this factor on the behavior of electrolytes is such as if oppositely charged ions would compete for the solvent molecules. The second factor depends on the interaction between free ions and the solvent. The first factor predominates at higher concentrations, the second at lower. 5. The tetrahedral structure of liquid water and the lack of spherical symmetry of NH_4^+ , OH^- and $(\text{H}_2\text{O}\cdot\text{Li})^+$ are responsible for the difference in the behavior of solutions of these ions as compared with those of other alkali ions. The application of the macroscopic dielectric constant of water to the solutions by both these groups of ions is not adequate, even in the region of the smallest concentrations investigated.

ANODIC TREATMENT OF PLAIN CARBON STEELS

By ROBERT L. IMBODEN AND ROBERT S. SIBLEY

Specimens of low carbon steels, previously prepared on 3/0 metallographic paper for metallographic study, were anodically treated for polishing and etching. Five electrolytic baths were found satisfactory, three of which gave excellent results. One bath, composed of 40% sulfuric acid, 46% phosphoric acid, 4% dextrose, 10% water, used a current density of 1.5 to 4.5 amp./sq. in. (23 to 70 amp./dm.²), bath temp. of 28 to 40°C ., and 5 to 10 minutes for polishing. Another bath, composed of 15% sulfuric acid, 65% phosphoric acid, 5% chromic acid, and 15% water, used 3 to 7 amp./sq. in. (47 to 109 amp./dm.²), bath temp. of 42 to 55°C ., and 3 to 5 minutes for polishing. The third bath was organic, 765 cc. acetic anhydride, 185 cc. perchloric acid, 50 cc. water, 0.25 to 0.8 amp./sq. in. (3.9 to 12.5 amp./dm.²), bath temp. below 30°C ., and 5 to 10 minutes for optimum polishing. Etching of the samples occurred at slightly lower current densities. Theory of electropolishing is discussed covering (1) preferential removal of scratch ridges; (2) longer time required by vigorous agitation; (3) formation of undulations; (4) pitting around surface inclusions; and (5) mechanical polishing vs. electropolishing. Types of cells applicable for preparation of samples for metallographic study are shown. It is important to perform a two-dimensional study on the specimens if a true metallographic history of the sample is desired. Sixteen micrographs are shown.

STUDIES ON OVERVOLTAGE. XIV

By A. L. FERGUSON AND MYRON B. TOWNS

This paper is a study of the influence on cathode charge curves, for platinized platinum cathodes in 2 N H_2SO_4 , of conditions that alter the hydrogen concentration on the solution side of the electrode-electrolyte interface. The purpose is to secure information relative to a theory of polarization potential proposed in a previous paper by the senior author. The results show definitely that the cathode potential, both below and above the so-called reversible value, can be materially altered for a given current density by conditions on the solution side of the interface which influence the rate of diffusion of hydrogen away from or to the interface. The changes produced are all such as were expected on the basis of the proposed theory.

THE THEORY OF THE POTENTIAL AND THE TECHNICAL PRACTICE OF ELECTRODEPOSITION

V. The Two-Dimensional Rectangular Enclosures

By CHARLES KASPER

This is the fifth in a series of papers on the interrelation of the theory of the potential and the technical practice of electrodeposition. The paper deals with rectangular enclosures. It is shown how these systems can be employed to analyze practical problems in electrodeposition, for example: (1) the uniform plating of a circular cylinder with an enclosing anode in the form of a square; (2) the use of a wedge to plate into an internal right angle; (3) the curvatures that must exist at the apex of the angle in order that procedure (2) be practicable; and, (4) the effectiveness of insulating one side of the wall of a right angle to obtain a more uniform current distribution. A number of original problems in the theory of the potential are also included.

THE ELECTRIC RESISTANCE AND ANISOTROPY OF ARTIFICIAL GRAPHITE BETWEEN 290° K. AND 12° K.

By A. GOETZ AND A. HOLSER

The electrical resistivity, ρ , of artificial graphite is determined between room temperature and about 12° K. on rods cut parallel and normal to the extrusion direction of the sample material. The temperature ranges continuously explored were 295° K. to 130° K.; 90° K. to 65° K.; and 20° K. to 11° K. In the transversal direction the resistivity is about twice as large as in the longitudinal; this ratio changes but little with temperature. The temperature coefficient of the resistivity ($d\rho/dT$) is positive (in contradistinction to natural graphite); ρ about doubles between 295° K. and 12° K. The non-metallic behavior of ρ is suggested to be due to the extremely small particle size of artificial graphite.

ADSORPTION POTENTIALS AT GAS-SOLID INTERFACES

By ARTHUR A. FROST

An improved apparatus for the study of potentials due to adsorption of vapors at solid surfaces is described. Typical results are presented and discussed. A possible application of the experimental technique to the detection of odors is suggested.

LOCATION OF GROUND FAULTS ON SERIES ELECTROLYTIC CELL SYSTEMS

By V. F. HANSON AND F. G. LAVIOLETTE

The presence of ground faults on electrolytic cell banks greatly increases the danger of electrical shock to operators and may cause serious electrolytic corrosion of cell parts. An equation is developed for locating such ground faults on isolated series cell banks by their effects on the electrical resistance of the cell bank to ground and on the d.c. voltage to ground from the center point of the bank. Various methods for making these measurements are described and compared. Although the derivation of the methods for locating grounds may at first seem somewhat involved, the actual measurements and calculations are simple and direct.

THE EFFECT OF TEMPERATURE ON THE RATE OF SELF DISCHARGE OF LEAD ACID STORAGE BATTERIES

By A. C. ZACHLIN

The rate of self discharge of starting-lighting-ignition (SLI) automobile batteries is compared at various temperatures ranging from -2° to 47° C. It is expressed as the rate of drop of specific gravity of the electrolyte in the cells in terms of 0.001 specific gravity units per day. From a value of 0.0012 to 0.0019 specific gravity drop per day at 26.7° C., this rate diminishes slowly to a vanishingly low value at about -2° C. Above room temperature it increases rapidly to over 0.005 specific gravity per day at 47° C. At tropical temperatures the rate of self discharge of storage batteries becomes so rapid that it makes the retention of charge a problem of critical importance.

REACTION RATES IN IONIC SOLUTIONS

By P. DEBYE

Smoluchowski's method of evaluating the fundamental frequency factor for the rate of a reaction like the coagulation of colloidal suspension by employing a purely diffusional treatment is extended to include the electrostatic effects arising from the presence of net charges. The introduction of the concept of a diffuse ionic cloud and the potential calculated therefrom leads to the following results: (a) The well-established Bronsted-Debye primary salt effect formula is derived. (b) The so-called "solvent" term of the Christiansen-Scatchard equation arising from the self potential of the ions is also derived but appears as the linear approximation of an exponential expression. The conspicuous absence of quantum theory in evaluating the absolute rate of a kinetic reaction merits attention.

THE ELECTROLYSIS OF GRIGNARD REAGENTS: SHORT-LIVED FREE RADICALS IN ETHYL ETHER

By RALPH PEARSON AND W. V. EVANS

By electrolyzing appropriate Grignard reagents it has been possible to study the behavior of the simple aliphatic and aromatic free radicals at ordinary temperatures and in the presence of a solvent. A great number and diversity of products were prepared, ranging from ethane to normal tetradecane. The method is far superior to thermal methods.

CURRENT LEAKAGE THROUGH CASCADED CELLS

By Y. S. TSOU

The current leakage through cascaded cells is usually small, but it may become quite large when a large number of cells is cascaded and combined into a single unit. A method of calculating the current leakage based upon Kirchhoff's law is presented with certain simplifications to facilitate its application. Methods of minimizing the amount of leakage current are suggested.

THE SPECIFIC HEAT EQUATIONS FOR CARBON DIOXIDE, CARBON MONOXIDE, STEAM, HYDROGEN, AND OXYGEN AND THE FREE ENERGY EQUATION FOR THE WATER-GAS REACTION

By M. DEKAY THOMPSON

The least square solutions for the specific heat equations of the above gases are worked out for the forms $C(p) = a + bT + cT^2$, $C(p) = a + bT + cT^2$, and $C(p) = a + bT + cT^{3/2}$, and the sums of the squares of the deviations of $C(p)$, $\sum \text{dev.}^2$ calculated by each equation, from the experimental values, are compared. The equation giving the smallest $\sum \text{dev.}^2$ being the best, it is found that for the temperature range of 300° to 3,000° or 3,500° K. the T^2 equation is the best for carbon monoxide and steam, the T^2 equation is the best for hydrogen, the $T^{3/2}$ equation is the best for carbon dioxide and for oxygen. The equation for ΔG° of the water-gas reaction is then computed and the values of $\log K$ computed by this equation are compared with the values obtained directly from spectroscopic observations.

A STRANGE PHENOMENON IN PLATING

By OLIVER P. WATTS

Upon electrolyzing a hot nickel sulfate plating solution at current densities of 35 to 60 amp./dm.², good, adherent deposits of nickel were obtained on the back of the cathode, but none on the front. The solution contained 10 to 40 g./L. NiSO₄ and 200 to 250 g./L. Na₂SO₄. This "back-plating" is attributed to the thick alkaline film formed on the front face of the cathode. By actual measurement it was found that only one-fourth of the current passed to the back of the cathode.

INDIUM SOLDERS

The urgent need for conservation of tin in the usual lead-tin solders has caused extensive research to be done on the lead-silver solders which have been familiar for many years but which have not enjoyed wide use due to their relatively high melting point and their poor spreading qualities. In an attempt to overcome these disadvantages, different metals have been added to lead-silver solders with varying degrees of success.

Eliminating tin entirely from their experiments, the Indium Corporation of America, 60 East 42nd St., New York City achieved a solution to this problem by adding indium to lead-silver solders. A report made to them by The Electrical Testing Laboratory of New York City on a comparison of samples of lead-silver solders and lead-silver-indium solders proved that additions of small percentages of indium materially improved the coverage, spreadability and bonding strength of such solders.

The samples tested were numbered 1, 2, and 3 respectively and their compositions were stated to be as follows:

Sample No.	Percentage Composition		
	Lead	Silver	Indium
1	96	3	1
2	95	3	2
3	97	3	0

Bonding strengths were tested by the following method: Strips of copper 0.5" wide and about 0.07" thick were soldered together with lap-joints 0.75 to 1.00" long, using a small blow-torch for heating. When cool, these specimens were tested for tensile strength in a standard tensile machine of suitable capacity. The results of this test are given in table shown above.

Spreading ability of these samples was tested by placing pieces of them, weighing 0.5 g. \pm 0.02 g. on sheets

Physical Properties of Various Solders

Sample No.	Test No.	Dimensions, in.	Area sq. in.	Breaking Load lb.	Holding strength, psi	Approx. coverage per cent
1	1	0.53x0.75	0.40	1100	2750	50
	2	0.55x0.94	0.52	1524	2930	100
	3	0.55x0.95	0.522	1575	3020	100
2	1	0.50x0.70	0.35	Average 914	2900	50
	2	0.50x0.75	0.375	1470	2600	100
	3	0.50x0.80	0.40	1600	3900	100
3	1	0.53x0.71	0.375	Average 900	3500	40
	2	0.50x0.85	0.425	975	2400	70
	3	0.50x0.88	0.44	390	900	90
	4	0.50x1.00	0.50	625	1250	90
				Average	1710	

Spreading Ability of Solders on Copper and Brass

Metal	Flux	No.	Spread		Remarks
			Wetted area hundredths of	an inch	
Brass	Zinc chloride	1		40x45	Nearly circular, smooth
		2		50x45	Nearly circular, smooth
		3		20x40	Irregular, not fully melted
Brass	Paste	1		40x45	Each as above, with a little more spread
		2		45x45	
		3		35x45	
Copper	Zinc chloride	1		25x30	Slight spread
		2		55x30	Moderate spread
		3		20x25	Very slight spread
Copper	Paste	1		30x35	Moderate spread
		2		40x35	Moderate spread
		3		25x40	Moderate spread

Additional Physical Data on Silver-Lead-Indium Solders

Sample No.	Composition	Melting Point	Tensile Strength
1	96%Pb; 3%Ag; 1%In	310°C.	4970 lb./sq. in.
2	95%Pb; 3%Ag; 2%In	311°C.	5280 lb./sq. in.

of brass and copper about 1/16 in. thick, with a flux as indicated, and then heating with a constant blow-torch flame applied to the under-side

of the sheet until flowing of the solder ceased. The results of this test are shown in the table above.

(Concluded on page 596)

DETERMINATION OF SULFATE IN THE PRESENCE OF CHROMATE[†]

By William B. Meldrum and William E. Cadbury, Jr.

Haverford College, Haverford, Pa.

and Walter W. Lucasse

*University of Pennsylvania,
Philadelphia, Pa.*

IN A STUDY of the system sodium sulfate-sodium chromate-water¹ it was found necessary to analyze solutions and solid mixtures containing both sodium sulfate and sodium chromate. Accurate analysis of sulfate-chromate mixtures for sulfate is made difficult by contamination of the barium sulfate precipitate with coprecipitated barium chromate, which forms mixed crystals with barium sulfate. To prevent this coprecipitation, the chromate may be reduced to chromic salt, acetic acid added, and the sulfate precipitated in the usual way. Willard and Schneidewind² describe and discuss this method in some detail.

In this paper, an alternative method for the determination of sulfate in the presence of chromate is described. Sulfate is precipitated from acid solution with barium chloride in the usual manner, and the necessary correction for coprecipitated barium chromate is determined and applied.

Reagents and Solutions

SODIUM SULFATE. Reagent grade sodium sulfate was twice recrystallized as decahydrate, the crystals being separated centrifugally from the mother liquor. They were then placed in a platinum dish and dehydrated by heating, gently at first, then strongly in a muffle furnace. The mass was powdered in a mortar, heated again, and kept in a weighing bottle in a desiccator until used.

SODIUM CHROMATE. Pure sodium chromate was prepared from reagent grade sodium dichromate by the method of Richards and Kelley², which differs from the more usual methods of purification in that it removes sulfate, the sodium salt of which is isomorphous with sodium chromate in all its hydrated forms¹. The salt thus prepared was dehydrated and kept in a weighing bottle in a desiccator.

SODIUM CARBONATE. Reagent grade anhydrous salt was used without further purification.

BARIUM CHLORIDE SOLUTION. Reagent grade salt, without further purification, was dissolved in distilled water.

SODIUM THIOSULFATE SOLUTION, 0.05 N. About 32 grams of reagent grade salt were dissolved in 2.5 liters of freshly boiled distilled water in a bottle which had been thoroughly steamed. This solution was standardized against twice recrystallized reagent grade potassium dichromate.

IODINE SOLUTION. About 16 grams of iodine were dissolved in 2.5 liters of potassium iodide solution containing about 20 grams of potassium iodide per liter.

STARCH SOLUTION. This solution was freshly prepared from potato starch each day on which it was needed.

This paper is presented because it suggests a simple, accurate procedure for obtaining sulfates in chromic acid anodizing solutions. The sulfate is precipitated as barium sulfate with some adsorbed barium chromate or a solid solution of barium sulfate and chromates. The chromate is determined by an iodine-thiosulfate titration after a sodium carbonate fusion.—Ed.

TABLE I. REPRESENTATIVE RESULTS

Na ₂ SO ₄ Taken Gram	Na ₂ CrO ₄ Taken Gram	Wt. of Ppt. Gram	Na ₂ SO ₄ (Uncor- rected) Gram	BaCrO ₄ in Ppt. Gram	Na ₂ SO ₄ Found Gram	Error Gram
0.0162	1.93	0.0424	0.0258	0.0162	0.0159	-0.0003
0.0291	2.18	0.0646	0.0393	0.0159	0.0294	0.0003
0.0468	0.345	0.0810	0.0493	0.0045	0.0466	-0.0002
0.0550	0.340	0.0935	0.0569	0.0031	0.0550	0.0000
0.0596	0.155	0.0992	0.0604	0.0012	0.0596	0.0000
0.0608	0.124	0.1023	0.0623	0.0017	0.0612	0.0004
0.0760	0.339	0.1297	0.0789	0.0039	0.0766	0.0006
0.0811	0.11	0.1370	0.0834	0.0032	0.0814	0.0003
0.0827	0.166	0.1373	0.0836	0.0018	0.0825	-0.0002
0.0850	0.328	0.1475	0.0898	0.0078	0.0850	0.0000
0.0935	0.268	0.1581	0.0962	0.0058	0.0927	-0.0008
0.1000	0.102	0.1665	0.1013	0.0009	0.1008	0.0008
0.1127	0.802	0.2017	0.1227	0.0179	0.1119	-0.0008
0.1153	0.758	0.2080	0.1266	0.0178	0.1157	0.0004
0.1490	1.020	0.2581	0.1571	0.0135	0.1489	0.0001
0.1503	0.093	0.2485	0.1512	0.0015	0.1503	0.0000
0.1868	0.398	0.3098	0.1885	0.0020	0.1873	0.0005
0.2213	0.285	0.3770	0.2295	0.0126	0.2218	0.0005
0.2482	0.169	0.4093	0.2491	0.0005	0.2488	0.0006

Procedure

Dissolve the sample in about 75 ml. of water and add 5 ml. of concentrated hydrochloric acid. Heat to boiling, and add very slowly, dropwise, from a separatory funnel, about 75 ml. of barium chloride solution of such concentration as to give a small excess of barium ion over that needed to precipitate all the sulfate. After adding the precipitant, digest the mixture just below the boiling point for at least 3 hours. Cool, filter off the precipitate on a quantitative paper, and wash thoroughly to remove all traces of chromate from the paper. The chromate in the form of mixed crystals with barium sulfate cannot be removed by washing.

[†] Reprinted from "Industrial and Engineering Chemistry", Analytical Edition, July 15, 1941, pp. 456-7.

Place the moist paper with the precipitate in a weighed platinum crucible and place the crucible in a cold electric muffle furnace. Adjust the current so that the furnace attains a temperature of about 300° C. in an hour. With this rate of heating, the paper burns off evenly and completely, without at any time bursting into flame. After an hour, remove the crucible from the furnace, cool in a desiccator, and weigh again. The difference in weight is the weight of barium sulfate plus the coprecipitated barium chromate.

Add to the crucible about 5 grams of anhydrous sodium carbonate and heat strongly in the oxidizing flame of a blast lamp until the precipitate has dissolved in the melt.* Remove the flame, and after the melt has solidified, but while it is still hot, place the crucible in a 400-ml. beaker containing about 150 ml. of gently boiling water. When the melt has disintegrated, which takes about 10 minutes, remove the crucible from the beaker and wash thoroughly, pouring the washings back into the beaker. Filter off, wash, and discard the precipitated barium carbonate, collecting the filtrate and washings in a beaker containing about 20 ml. of concentrated hydrochloric acid. The filtrate now contains sulfate, chromate, dichromate, chloride, hydrogen, and sodium ions.

When the solution has cooled, add freshly prepared potassium iodide solution. Titrate with standard sodium thiosulfate solution the iodine set free by the chromate, adding only a slight excess of thiosulfate. Titrate back with standard iodine solution, using starch solution as indicator. Subtract the weight of barium chromate thus obtained from the weight of the mixed precipitate to obtain the weight of barium sulfate.

Discussion of Procedure

In the procedure described, the concentration of hydrochloric acid in the solution to which barium chloride is added is higher than is usually recommended for sulfate precipitations. This was found to be necessary in order to keep the coprecipitation of barium chromate from assuming too large proportions.

A Gooch crucible with asbestos filter cannot be used for the filtration, since when asbestos has been fused in sodium carbonate and the melt extracted with water, the solution

contains substances which liberate iodine from potassium iodide. Consequently filter paper (Whatman No. 40) was used and was found satisfactory. Tests showed that chromate was not reduced when ignited in contact with filter paper in a muffle furnace.

Other methods for determining the correction to be applied, in which the precipitate was dissolved in concentrated sulfuric acid prior to further treatment, were tried and found unsatisfactory.

Results

Samples of known weight prepared from the purified reagents were dissolved in water and analyzed by the above procedure. The quantity of sodium sulfate used was varied from about 0.05 to 0.25 gram, and the ratio of sodium sulfate to sodium chromate was varied from 2.5:1 to 1:7.5. Table I gives data selected at random from the results obtained.

Columns 1 and 2 give, respectively, the weights of sodium sulfate and of sodium chromate taken. Column 3 gives the weight of the precipitate of mixed barium sulfate and barium chromate obtained. Column 4 gives the weight of sodium sulfate found, calculated on the assumption that all the precipitate is barium sulfate. This quantity, by comparison with the corresponding quantity in column 1, is considerably in error. Column 5 gives the weight of barium chromate in the precipitate, determined as described above. Column 6 gives the weight of sodium sulfate found after the correction has been applied, and column 7 gives the difference between this quantity and the weight of sodium sulfate taken.

It is evident from these results that this method of determining sulfate adequately meets the ordinary analytical requirements.

Literature Cited

- (1) Cadbury, W. E., Jr., Meldrum, W. B., and Lucasse, W. W., forthcoming publication.
- (2) Richards, T. W., and Kelley, G. L., *J. Am. Chem. Soc.*, 33, 847 (1911).
- (3) Willard, H. H., and Schneidewind, R., *Trans. Am. Electrochem. Soc.*, 56, 333 (1929).

INDIUM SOLDERS

(Concluded from page 594)

Specimen No. 1 of each sample was made using a prepared soldering compound as flux; the others were made by using zinc chloride. After fracture it was observed that the solder at the joints of Sample No. 3 had considerable slag inclusion. The others had very little. All samples spread better on brass than on copper and spread better with paste than with zinc chloride. In each of the four groups, Sample No. 2 (the solder having 2 per cent indium added) spread farthest and most smoothly. Sample No. 3 (the solder without indium) spread least and had a rough surface as though only partly fused.

Corrosion Prevention of Metals

U. S. Pat. 2,293,716. V. M. Darsey, assignor to Parker Rust Proof Co., August 25, 1942. A process which comprises treating surfaces of one of the group consisting of iron, steel, zinc and cadmium with an acid phosphate coating solution containing nitrate and chlorate and maintaining the pH above 2.5 and not over 2.9.

Example:	
Nitric acid, 52°	400 lb.
Phosphoric acid, 75%	1,075 "
Zinc oxide	420 "
Sodium chlorate	500 "
Copper carbonate	2.5 "
Water to make	5,000 "

For use, dilute 500 lb. of the above concentrated material to 1,000 gallons of water. The solution is operated at 115° to 170° F. and a pH of 2.7. The operating bath will analyze approximately:

Free acid	1.5 cc.
Total acid	15.4 cc.
Zinc	0.52%
Nitrate	0.56%
Chlorate	0.40%
Copper	0.0008%
Phosphate	0.68%

The free and total acid are the number of cc. of N/10 sodium hydroxide required to titrate a 10 cc. sample of solution using methyl orange and phenolphthalein respectively. The solution can be sprayed on the work. A replenishing composition may contain:

Nitric acid, 42°	425 lb.
Phosphoric acid, 75%	2,240 "
Zinc oxide	670 "
Sodium chlorate	448 "
Copper carbonate	22 "
Water to make	5,250 "

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Hogaboom Heads Electroplating Unit

stitution Division.

See Local WPB Office First

Washington with their problems because, according to an official announcement, they "can usually get quicker action in the field."

1943 PRP Forms Ready

are being mailed to those operating under the plan. With these forms is sent an instruction booklet with a Fabricated Product Classification List which aims to help fix terminology. To balance properly the requirements with available supplies, reductions in allotments were necessary in planning the first quarter of 1943. In this quarter certain essential non-military items will be given the rating of AA-5. This new rating was created to give these items the highest possible rating and yet avoid having them compete with the lowest military rating of AA-4.

A New Fuel

The Bureau of Mines of the Department of Interior has suggested a mixing of coal and oil to produce a new liquid fuel which it believes is suitable for use in some industrial oil-burning furnaces. Dr. R. R. Sayers, Director of the Bureau of Mines, is of the opinion that this new fuel would save 30 to 35 per cent of the fuel oil ordinarily consumed and that many industrial furnaces could use this oil-coal fuel without material alterations in boilers and burners.

Advertising Is Being Watched

papers, general magazines and trade publications to stop code leaks to the enemies of the United States.

PAB and Advertising Cost

announced that war contractors advertising costs which bear a necessary reasonable relationship to their business activities "will be deemed reasonable by governmental price agencies when reviewing over-all corporate profits." These agencies will follow the Treasury Department's method of allowable advertising costs. On cost-plus-fixed-fee contracts, industrial or institutional advertising in trade or technical journals which can be properly "classified as an operating expense incurred for reasons of policy, may under certain circumstances be admitted." And in the case of fixed-price contracts, where field procurement officers may request a breakdown of costs it has been suggested that contractors should include advertising costs in overhead expenditures rather than as a separate cost item.

George B. Hogaboom is head of the Electroplating and Finishing Unit under Dr. A. Kenneth Graham, Chief of the Non-Metallic Section of the WPB Conservation and Sub-

Businessmen are being urged by the War Production Board to go to the local WPB office before coming to

The Production Requirements Plan application forms (PD-25-A) which are to be used in the first quarter of 1943 have been approved and

Reasonable Advertising Costs Tests

tax returns. "The test of whether expenditures for advertising are deductible is whether they are ordinary and necessary and bear a reasonable relation to the business activities in which the enterprise is engaged. This is not intended to exclude institutional advertising in reasonable amount or good-will advertising calculated to influence the buying habits of the public. If such expenditures are extravagant and out of proportion to the size of the company or to the amount of its advertising budget in the past, or if they are not directed to public patronage which might reasonably be expected in the future, such payments will be disallowed as deductions."

Air Raid Protection Devices

importance to the war effort because of an increased nationwide demand for alarm systems, blackout ventilating equipment, camouflage paint, dim-out lighting fixtures, fire extinguishing equipment, and other protective devices, the War Production Board ruled on October 1, 1942 that all applications for such protective devices must be made to the WPB's Resources Protection Board which consists of representatives of the Navy Department, Office of Civilian Defense, War Department, and WPB. After giving the request careful consideration the application will be given a definite rating if it merits one.

Aluminum Instruction Films

Applications for the loan of these films should be addressed to the Bureau of Mines, Division of Information, Central Experiment Station, 4800 Forbes Street, Pittsburgh, Pennsylvania.

Aluminum Scrap Prices

maximum prices on borings, turnings, and similar machinings of aluminum scrap with oil, water and other forms of contamination shall be based on the actual weight of aluminum or aluminum alloy content.

Aluminum Scrap Prices

minimum price on all aluminum drosses, grindings, savings, skimings, spatters and sweepings with less than 15 per cent of aluminum content was limited to 1.2 cents per pound.

Average Hours and Wages

tries throughout the United States, the average hours worked per week were 42.4; the average hourly earnings were 85.0 cents; and the average weekly earnings were \$38.52.

**Bonded
Abrasives**

Every manufacturer of bonded abrasives, according to Maximum Prices for Special Bonded Abrasives Order No. 96 issued on October 14, 1942, must now file with the Office of Price Administration a detailed explanation of his formula or formulas of pricing such abrasives during the month of March, 1942. He must also report details on his gross sales during the second quarter of 1942.

**Brass in
Scales
Banned**

The use of brass in the major parts of industrial scales was banned by WPB's Scales, Balances, and Weights Limitation Order L-190, dated October 10, 1942.

**Certificates
of Necessity
Required**

Applications for Certificates of Necessity are being mailed by the Office of Defense Transportation to every person in the United States who was registered as an owner of a commercial automotive vehicle on December 1, 1941 because General Order ODT No. 21 which becomes effective on November 15, 1942 provides, among other things, for tire inspection every 60 days or 5,000 miles, whichever comes first, by an authorized OPA inspector. The owner must receive the approval of the inspector for continued operation of his vehicle, and no inspection fee is charged "unless it is necessary to remove a tire from the wheel or rim."

**Chemical
Maintenance
Restrictions
Eased**

Since the chemical industry is a vital war production industry, the WPB issued on September 19, 1942 Amendment No. 3 to Preference Rating Order P-89 as amended which grants new higher preference ratings to chemical producers to obtain maintenance, repair and operating supplies. An A-1-a rating has been assigned to the industry to obtain metals appearing on List No. 1 of Form PD-25-A, and for fabricated parts and equipment having a unit cost of \$250 or less. An A-1-c rating was assigned to other materials needed for maintenance, repair and operating purposes.

**Chromium
Chemicals
Uses Curbed**

The restricted use in any month to one-twelfth the amount used in the base period of primary chromium chemicals, including sodium bichromate, potassium bichromate, sodium chromate and all chromium tanning compounds by Chromium Order M-18-b, as amended June 27, 1942 was fixed by Supplementary Order M-18-b on September 30, 1942. While this order will not increase the availability of chromium chemicals because of the restriction of Order M-18-a, yet it will permit an inventory of 30 days supply.

**Coin Metal
Changes**

Secretary of the Treasury, Henry Morgenthau, Jr., recently announced that the United States Mint has cut the production of one cent pieces by 50 per cent for the purpose of conserving copper for war purposes. To bring "hidden" cents into circulation, the Director of the Mint is urging the scrapping of children's "piggy banks" and placing such savings in war savings stamps and war savings bonds. The new "nickel-less nickel" is now in the process of production.

**Contract Board
Appeals Created**

War Department contract forms have been changed to provide that the recently appointed Board of Contract Appeals may act as the representative of the Secretary of War. This Board, which consists of Colonel Hugh C. Smith, Major Eugene E. Pratt, and Major Roswell M. Austin, was created to speed the adjudication of contractual appeals. The Board will render final decisions on appeals ordinarily requiring the action of the Secretary of War.

**Copper
Inventory
Stock Seized**

Because of its refusal to sell 140,000 pounds copper inventories to the Government, the Office of the United States Marshall in Topeka, Kansas, on October 9, 1942, seized this stock from the Sunshine Mantle Company of Chanute, Kansas.

**Conveying
Machinery
Order**

To conserve conveying machinery and mechanical power transmission equipment for the mass production of guns, planes, tanks, and other war machines, Limitation Order No. L-193, dated October 7, 1942, provides for mandatory filing of monthly production schedules, for the restriction of all orders except to recognized exceptions, and for the prohibition of engineering services except for authorized orders.

**Copper
"Black Market"**

It is the opinion of official Washington that some of the 25 per cent who failed to file their copper inventory questionnaires with the WPB either traffic in a "black market" or their stocks were illegally acquired. As a result warehouses are being carefully checked.

**Copper Scrap
for Foundries**

Beginning October 1, 1942, copper-base alloy scrap and copper scrap have been only available to foundries with preference ratings of A-1-a or higher. Monthly requirements of foundries must be made on Forms PD-59 and PD-123, according to Order M-9-b.

**Copper
Supply**

H. O. King, Chief of the WPB Copper Branch announced on October 4, 1942 that the total United States copper supply for 1939 was 1,525,500 short tons as compared with 1,913,800 tons in 1940, with 2,467,100 tons in 1941, and 2,571,700 tons (estimated) in 1942.

**Data Requests
Criticisms**

The Committee for the Review of Data Requests from Industry, which was appointed to investigate the complaints of businessmen because of the amount of paper work such requests placed on industry, has revealed the preliminary results of its survey. Chairman Joseph I. Lubin states that in analyzing the businessmen's letters which expressed their views on the forms used it was found that 95 per cent complained of (1) unavailable data, (2) receiving forms which were not applicable to their particular business, (3) oversized forms, (4) meaningless data, (5) conflicting instructions, and (6) ambiguous phrases. Thus far, the Committee has eliminated 120 WPB forms and simplified 130 others. With a few exceptions, all WPB forms have been standardized in size to fit into the average typewriter.

**Fuel Oil
Ration
Applications**

The Office of Price Administration has ordered that applications to secure fuel oil rations for all non-heating purposes in industrial establishments must be made on Form 1102.

**Gold Mining
Practically
Stopped**

Gold Mining Limitation Order L-208, dated October 8, 1942, which affects several hundred mines and about 5,000 miners, has stopped all gold mining except some small lode mines which produced less than 1,200 tons in 1941. The mines' machine shops, mills and other facilities may only be used in the manufacture of articles which have a preference rating of A-1-k or higher. The purpose of this Order is to make these miners available to vital materials mines.

**Hairpin and
Bob Pins
Restricted**

General Limitation Order L-104, as amended September 25, 1942, has restricted the production of metal hairpins and metal bob pins to 25 per cent of the 1941 production during the period September 25, 1942 to September 30, 1943. All appeals for relief from this Order must be made on Form PD-500.

**Materials
Branch
New Chief**

The newly appointed Chief of the Materials Branch of the Program Coordination Division of the WPB is Walter E. Heller, president of the Walter E. Heller & Company of Chicago and New York.

**Machine and
Parts Price
Exemptions**

Amendment No. 27 to Maximum Price Regulation No. 136, as amended, issued October 6, 1942, rules that the sale of a machine or machine part sold under a rental contract made prior to July 22, 1942, which provides for the transfer of title to the lessee when the rental payments, plus the monthly carrying charges, equal the value of machine or machine part at the time of making the contract that such price is not subject to price control.

**Materials
Redistribution
Branch**

The Chief of the recently created WPB Materials Redistribution Branch is Colonel Charles R. Baxter, Ordnance Department, United States Army. The personnel and functions of the Inventory and Requisitioning Branch will be taken over by this branch.

**Metal Economics
Chief Named**

Thomas H. Miller, a mining engineer, metallurgist, and authority on metallic minerals, who was in charge of the preparation of the chapters on non-ferrous metals in the Minerals Yearbook of the Department of Interior's Bureau of Mines has been named Chief of the Metals Economic Division of the Bureau of Mines.

**National
Tinsel
Manufacturing
Company**

The National Tinsel Manufacturing Company of Manitowoc, Wisconsin, has been denied the allocation of scarce materials and priority assistance from October 12, 1942, to January 12, 1943 because of its violation of WPB's copper conservation orders.

**Nickel
Restrictions
Tightened**

The control of nickel was tightened by a revision of Conservation Order M-6-b on October 3, 1942. The revised Order restricts the use of nickel to such war equipment as aircraft, ammunition, armament, ships, tanks and other products certified by the Army-Navy Munitions Board.

**NWLB Wage
Increase
Order**

The National War Labor Board's General Order No. 5, issued on October 14, 1942, provides that individual wage adjustments are permissible without the approval of the Board if they are made as a result of: "a. Individual promotions or reclassifications; b. Individual merit increase within established rate ranges; c. Operation of an established plan of wage increases based upon length of service; d. Increased productivity under piecework or incentive plans; and e. Operation of an apprentice or trainee system."

**Panama Canal
Restrictions
Removed**

Amendment No. 1 to Supplementary Order No. 8, dated October 12, 1942, has removed from all price regulations the sale and shipment of commodities to the Panama Canal Zone.

**PAP
Procedure**

The Price Adjustment boards of the Army, Maritime Commission and Navy, in a joint statement on October 7, 1942, declared that when the over-all profits of manufacturers are under review of the price adjustment agencies, their individual contracts will not be subject to review of contracting officers at the same time.

**Petroleum
Coke
Restrictions**

The delivery and use of petroleum coke has been banned by Conservation Order M-212, dated October 10, 1942, except in the making of such articles as cathodes, dry battery electrodes, electrical contacts, moulded specialties, silicon carbide abrasives, and twenty-five other products mentioned in the Order, "including graphite and carbon electrodes, anodes for aluminum, magnesium and alloy steel manufacture."

**Office of
Technical
Development**

For the purpose of setting up a strong scientific and technical organization to make sure that the Nation's technical ability and resources are utilized to the full in our war production program, Chairman Donald M. Nelson appointed a committee of engineers and scientists to determine the scope, functions and methods of operations of the proposed Office of Technical Development. Those appointed are Dr. Lawrence W. Bass, Director of Research, New England Industrial Research Foundation, Boston, Massachusetts; Dr. Oliver E. Buckley, President, Bell Telephone Laboratories, New York City; Col. Clarence E. Davis, Ordnance Department, U. S. Army, Washington, D. C.; Dr. Ray P. Dinsmore, Manager, Development Department, The Goodyear Tire and Rubber Company, Akron, Ohio; Admiral J. A. Furer, U. S. Navy, Washington, D. C.; Dr. Jerome C. Hunsaker, head of the Departments of Mechanical and Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts; H. W. Graham, Director of Metallurgy and Research, Jones and Laughlin Steel Corporation, Pittsburgh, Pennsylvania; S. D. Kirkpatrick, Editor, Chemical and Metallurgical Engineering, New York City; and Webster N. Jones, Director of the College of Engineering, Carnegie Institute of Technology, Pittsburgh, Pennsylvania, who is chairman of the committee.

**Post-War
Planning
Pamphlet**

The National Resources Planning Board during the latter part of September issued for distribution an informative pamphlet entitled: "Post-War Planning". This pamphlet deals with such subjects as employment, personal security, private enterprise and planning, and industrial mobilization.

**Priorities
Regulation
No. 13 Amended**

Priorities Regulation No. 13 was amended on September 23, 1942, to clarify some ambiguities in the original Order, to restrict certain intra-company transfers of materials, and to exclude from the Order materials rationed at retail levels.

**Priority
Regulations
Amended**

Priorities Regulations Numbers 3, 11 and 12, which govern preference rating extensions for companies operating under the Production Requirements Plan, were amended on October 3, 1942. The amendments to Regulations Numbers 3 and 12 provide for greater flexibility in securing an extension of preference ratings to obtain operating supplies. Items for the repair of production machinery are now included as operating supplies. The amendment of Regulation Number 11 provides that "companies operating under PRP are given the privilege of extending ratings served on them instead of using the ratings assigned on their certificates to obtain materials which are not included in the Materials List accompany the PRP application."

**Price
Controls
Removed**

Beginning October 15, 1942, price controls were removed on the sale of services and commodities rendered under Office of Scientific Research and Development contracts and "secret" subcontracts, the OPA ruled with Supplementary Order No. 22, dated October 9, 1942.

**Ration Board
Regulation**

OPA Procedural Regulation No. 10, dated October 12, 1942, rules that no member of a Ration Board is permitted to take official action in the administration of any ration order in a case where he has a personal business interest or where there is a relationship by adoption, blood, or marriage.

Referee Board of WPB The Referee Board of the WPB Chemical Branch which passes on the merits of competing chemical processes and acts in an advisory capacity in detailing chemical raw material research problems to private laboratories, recently announced, through its Chairman Dr. Donald B. Keys, the appointment of its working staff which consists of Dr. Lawrence A. Monroe, Dr. W. M. Langdon, Dr. Carl Monrad, Dr. A. L. Elder, Dr. C. W. Lenth, E. M. Houts, and Walter Munster.

Regional Emergency Materials Plan A Regional Office Emergency Materials Plan was recently started by the WPB for the purpose of preventing stoppages or slow-downs in the movement of such critical materials as aluminum, brass, copper (refined), cadmium, cobalt, lead, molybdenum, nickel, tantalum, titanium, tin, tungsten, vanadium, and zinc. Under this plan the regional field officer is empowered to assign preference ratings up to AAA on essential production materials, and ratings up to AA-2X for other urgent materials.

Renegotiated Contracts Contractors who return money to the Government as a result of renegotiated contracts "should refund only the amount of profits above Federal income and excess profits paid or assessed on the sum involved" the Bureau of Internal Revenue has ruled. This ruling applies "in cases where the renegotiated agreement provides for reduced contract prices to be retroactively applied to prior taxable years for which returns already have been filed and income and excess profits already paid or assessed."

Safety Equipment Interpretation Interpretation No. 1, dated September 25, 1942, of Safety Equipment General Limitation Order L-114 makes it clear that the Order covers only indicating and measuring instruments to detect fires, and to prevent or reduce accidents, diseases, injuries and occupational hazards.

Silver as Copper Substitute The Conservation and Substitution Branch of the WPB recently announced that 24,000,000 pounds of copper were saved during the past few months by substituting silver for copper in making electrical conductors. To aid in saving copper for essential needs, the Treasury Department has allotted 34,000 tons of silver to the Defense Plant Corporation for non-consuming purposes.

Silver Processing Regulation The processing of foreign silver may be continued until November 15, 1942, if the operations began before October 1, 1942, according to Amendment No. 2 to Conservation Order M-199, dated September 29, 1942. After November 15, 1942, the processing of silver for orders bearing preference ratings of 3A or less must stop. The amendment redefined the term "manufacturer" to include laboratory, plating or repairing operations; it forbids the selling of foreign silver in any form except to suppliers designated by the Metal Reserve Corporation, and it removed "church goods" from the jewelry restriction.

Silver Salts Prices Adjusted On September 22, 1942, the OPA in the issuance of Amendment No. 27 to Supplementary Regulation No. 14 to General Maximum Price Regulation permitted silver salt prices to be increased to absorb the August 31, 1942 increase of imported silver bullion prices which rose from 35.375 cents to 45 cents per troy ounce.

Small War Plants Division Created Lou E. Holland, Deputy Chairman of the Smaller War Plants Corporation, has been appointed administrative head of the newly created WPB Small War Plants Division which will take over the functions of the abolished Bureau of Finance and the Contracts Distribution Branch.

SWPC Loans The Smaller War Plants Corporation is now prepared to carry out its primary objective—to make loans to small manufacturers from its \$150,000,000 fund. The Corporation's official statement dated September 30, 1942, states: "The Corporation's objective is to expand and speed up war production and to strengthen our war economy . . . We must give attention to the usual banking considerations and be able to see a reasonable prospect that the borrower will repay the loan . . . but we are not going to insist on gilt-edge security . . . In instances where acceptable guarantees cannot be furnished, it may be possible to arrange some sort of control over the funds we lend and in this way get around the obstacle which has prevented loans through other channels."

Solder Prices Increased All sellers of solder with a tin, lead or tin-lead base were granted permission in Amendment No. 38 to Supplementary Regulation No. 14 to General Price Regulation, dated October 10, 1942, to add 9.634 cents per fine troy ounce of silver content.

Sulfamic Acid Order Sulfamic acid and sulfamic acid derivatives were placed under complete allocation control on November 1, 1942, by General Preference Order M-242, dated October 3, 1942. Requests for allocation must be made on Form PD-600, and reports on distribution must be made on Form PD-601.

Technical Data Exported on Microfilms Exporters of technical data are being urged by the Office of Exports, Board of Economic Warfare, to ship such material on microfilm or other photographic film to conserve shipping space. The censorship offices in Los Angeles and New York are equipped to examine such films, preparatory for the issuance of an export license.

Carbon Tetrachloride Amendment The rating of B-2 was assigned to carbon tetrachloride when used for degreasing machines other than those used to fulfill Army and Navy contracts. Amendment No. 2 issued on October 10, 1942, to General Preference Order M-41 as amended May 2, 1942, permits an applicant to use 100 per cent of the average monthly consumption for the year ending September 30, 1942.

Tinplate Usage Restricted Conservation Order M-104 as amended September 26, 1942, prohibits the use of tinplate, terneplate and blackplate for closures for products as coffee; tea and teaballs; dry spices (except those containing salt, onion salt or garlic); candy; butter; peanut butter; lard; shortening and edible oils; baking powders; tobacco and tobacco products, including cigars and cigarettes; smoking and chewing tobacco and snuff; cements, including linoleum, radiator, show and belting cement; radiator anti-rust compounds, carbon removers, and knee-action or brake fluids; lighter fluids; oleic acid; dry cleaners and dry cleaning fluids; dry solvents; insecticides and agricultural disinfectants; printing, duplicating and lithographing ink; lubricating oil and cutting oil; medicinal oils, ointments, and petroleum jelly; graphite (where no water is present); and paste type waxes.

WPB Branches Combined The Safety and Technical Equipment Branch and the Health Supplies Branch of the WPB have been combined into a new branch known as the Health, Safety and Technical Supplies Branch. This new branch will embrace the Surgical Instruments Section, the Orthopaedic and Dental Section, the X-Ray Section, Safety and Equipment Section, Fire Equipment Section, and Technical and Scientific Section. Francis M. Shields is the Chief of the new Branch, and George W. Angell is Deputy Chief.

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. The questions this month are answered by G. B. Hogaboom, Jr., Nathaniel Hall and Dr. Walter R. Meyer. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Prevention of Hydrogen Embrittlement

Q. In the September issue of "Metal Finishing" you made the statement that hydrogen does not diffuse readily through cadmium. Can you give me any more information on this subject? I am interested in plating chromium upon steel without the hydrogen diffusing into the steel and perhaps cadmium can be used as a barrier to prevent this diffusion.

A. The works of Zappfe and Faust and others have indicated rather definitely that diffusion of hydrogen through cadmium is relatively nil, particularly when the coatings are greater than 0.0005".

Of course, there would be diffusion of hydrogen through thinner coatings of cadmium inasmuch as these coatings, like all other plated coatings, are porous. This was proved by the work of Fischer and Barman published in the September, 1941 issue of "Metal Finishing."

Zinc also is a barrier to hydrogen diffusion in thicknesses greater than 0.0005". However, we doubt whether the idea of using zinc or cadmium as a barrier to prevent hydrogen diffusion in chromium plating would be effectual because you would get some hydrogen embrittlement from the zinc or cadmium plating and it would be hard to remove the hydrogen entrapped during zinc or cadmium plating because of the low rate of diffusion of hydrogen through these metals. In addition, metals with such low tensile strengths as zinc and cadmium are relatively poor bases for the deposition of chromium.

Lead-Lined Containers for Hydrochloric Acid

Q. We recently had occasion to purchase a lead-lined tank for holding hydrochloric acid of approximately 1:3 dilution of commercial acid and after only 24 hours of use the tank was perforated. Will you let us know why the acid penetrated through the lead so quickly and tell us whether lead containers are suitable for holding hydrochloric acid?

A. The rapid penetration of hydrochloric acid through $\frac{1}{4}$ " of lead was evidently not due to solution of the sheet in the normal manner inasmuch as this may require weeks

or years depending upon the concentration and temperature of the acid and the type of lead. No doubt, penetration in this case occurred along the grain boundaries or possibly through ruptures in the crystals themselves, caused by fatigue. Lead has very low fatigue life. The working of the lead sheet plus lengthy transportation may have been sufficient to cause fatigue with subsequent attack at such points.

Soft, or chemical lead, which contains less than 1/10 per cent of copper, has relatively poor resistance to attack by hydrochloric acid solutions. This attack increases with the concentration of the acid and also with temperature. The solubility of lead chloride increases greatly with an increase in temperature. Lead behaves similarly to iron in hydrochloric acid, dissolving to form a chloride with the evolution of hydrogen. The reason why the reaction is not rapid is that the lead chloride is only slightly soluble at room temperature. For example, the solubility of lead chloride in water at room temperature is 0.67 g. per 100 g. of water.

The addition of antimony is recommended for lead linings meant to withstand hydrochloric acid. The protection afforded by antimony increases with up to more than 18 per cent antimony. However, hypereutectic alloys would not be practical because of their brittleness and therefore it is usually found advisable to employ antimony concentrations of the order of 7 per cent. The addition of antimony increases the fatigue limit of lead and also decreases the grain size.

Nickel Plating Spring Steel

Question: I have a problem of nickel plating upon ordinary spring steel made in the shape of a coil spring. A polished finish is desired. Will you suggest the cycle that I should use for this purpose and also the type of nickel solution. The spring must be flexed once in a while. Will this cause the plate to peel?

Answer: It is not understandable why nickel plating should have been specified upon the spring steel inasmuch as considerably heavier coatings of nickel must be applied than cadmium to get the same degree of corrosion protection.

Hydrogen embrittlement is a very important factor in the plating of spring steel and the embrittlement is greater with nickel plating than with cadmium plating. If no specification is given regarding plating, I would suggest applying 0.0001" of cadmium.

Your statement that a polished finish is desired is also difficult to understand inasmuch as brightness of the surface should not be a factor in the production of such items as springs for war purposes.

If the plating is properly done, the flexing of the spring should not cause the plate to flake off and, as a matter of fact, properly applied deposits do not flake even with rupture of the base metal.

A recommended sequence for finishing is as follows: alkaline clean, using either no current or the work as anode. After cleaning, the parts should be cleaned of oxides and scale mechanically, if at all possible. This can be done, providing the springs do not become nested, by tumbling with a fine abrasive and water to which sodium cyanide has been added. Sodium cyanide will dissolve rust rather slowly but this can be hastened by the mechanical action. In this way, oxide removal can be effected without hydrogen embrittlement. Following this, the springs are rinsed and then either nickel or cadmium plated. In cadmium plating, use relatively low current density of the order of 5-10 amp./sq. ft. to obtain highest cathode efficiency. The cathode efficiency of nickel solutions is not greatly affected by current density. A ductile type nickel solution such as the Watts type solution with pH between 5.0 and 5.5 is recommended.

The Watts solution is, of course, for tank plating. For barrel plating, a solution composed of

Single nickel salts	20 oz./gal.
Ammonium chloride	4 "
Boric acid	4 "

should be used.

Questions Answered

We wish to thank George F. Greene, Dorchester, Mass., for informing us regarding the "Oxoseal" process which is marketed by Oxoseal Co., Ltd., 1716-18 21st Avenue S., Seattle, Wash.

Our thanks also go to Linick, Green & Reed, Inc., 29 E. Madison Street, Chicago, Ill., for telling us about "Midnight Black" which was the name of a product used for blackening silver, silver plated articles and nickel plated articles by cold application. The product is now called "No. 37 'Plat-Chrome' Oxydize for Nickel and Silver."

Corrosive Action Between Copper and Chromium

Hamilton, Ont.

"Gentlemen:

Could you advise us as to what action or reaction will take place between chromium and cyanide copper plating?

We are building up shafts with a heavy cyanide copper plate for rust and corrosion resistance, and on one of the shafts we will have to build up with hard chromium, as it has been cut undersize.

What we want to know is what reaction will take place between the chromium and copper (which will be side by side) especially when they both will be subjected to salt water. Will the chromium be more inert to the copper than to steel?

It is noticed that chromium is positive to iron and copper, but that copper is negative to steel, by the tables of compiled E. M. F. also to chromium. Are chromium and copper far enough apart to be used together?

We mention that the copper will not be deposited on top of the chromium but will be deposited on one end of the shaft right next to the chromium.

Yours very truly,
R. P. P. Co., Ltd."

Answer: We can find no definite reports in the literature regarding the electrochemical effect between heavy chromium plate and copper. Frankly, we believe that there would be practically no electrochemical effect and if there is a slight effect, the copper will be slightly anodic to the chromium which means that there will be a slight increase in the rate of corrosion of copper.

The A.S.T.M. has reported such cases for stainless steel couples in salt solutions but we wish to repeat that the effect is so slight as to be negligible.

Of course, this would not be the case if the work were immersed in any solution that tended to activate the dissolving of chromium such as a salt solution acidified with a small amount of hydrochloric acid, in which case, the chromium would be anodic to the copper and would dissolve in preference to it.

Cyanide Dip Preceding Plating

Question: We have noted in the "1942 Plating and Finishing Guidebook" that a cyanide dip is recommended immediately preceding the first silver strike. Will you kindly explain the purpose of this dip?

Answer: There are several reasons for using a cyanide dip previous to plating in a cyanide solution. One is that the dip tends to neutralize any acid films that may be present after pickling. This is particularly important in automatic plating where the transfer time may be slow. The cyanide solution also has a solvent action on freshly formed films of iron oxides and hydroxides.

Another reason for the cyanide dip is they prevent reduction in the concentration of sodium cyanide by drag-in of water. The cyanide solution on the work entering the silver strike forestalls any danger that

plating of silver by immersion could take place due to a thin film of solution being diluted adjacent to the work.

Stripping of Gold Plate

Elkhorn, Wis.

"Gentlemen:

We tried to use the formula on page 99 of the Plating Guidebook, of cyanide and 30 volume peroxide, to strip gold plated band instruments, without success.

This article cautions about violent action and boiling over when the work is put in the solution. We had no boiling at all although we followed directions very carefully. Two lots were tried.

Can you help us with this problem? We are desperately in need of this strip as we have many instruments held up until we can get the gold off.

Yours truly,
G. Co."

Answer: The strength of hydrogen peroxide mentioned in the Guidebook should have been stated as 100 volume rather than 30 volume. This is also called 30 per cent hydrogen peroxide and is the strongest commercial grade. The expression "volume" when applied to hydrogen peroxide relates to the volume of oxygen gas evolved by one volume of the solution specified. Thus, the standard 3 per cent by weight solution of hydrogen peroxide is also called 10 volume. To repeat, the 30 per cent by weight concentration would be called 100 volume.

It is believed that you will get better results with the stronger hydrogen peroxide. Increasing the strength of the cyanide or slightly warming the solution will also accelerate stripping. Be sure to use good ventilation because of the danger of a violent gas evolution.

Cadmium Plating Malleable Iron

Philadelphia, Pa.

"Gentlemen:

I am sending you a cadmium solution which I would like you to analyze.

I am having trouble plating malleable iron which seems to blister and later shows large black spots which rust in a few days.

The work having oil on it, we first wash in naphtha, electroclean, rinse and follow with a short muriatic acid dip, rinse and then plate. After plating we are compounding with a soft buff to finish.

W. McC."

Answer: Analysis of your solution shows the following:

Cadmium	3.1 oz./gal.
Total cyanide	13.4 " "
Free cyanide	8.0 " "
Sodium carbonate	1.4 " "

The free cyanide is slightly low, a concentration of 9 oz./gal. being considered good for general plating, but for malleable iron plating, a lower free cyanide will give better results in that quicker covering will be obtained. Otherwise the solution appears to be O.K.

Preparation of the metal before plating is the most likely source of your trouble. Consider the following.

After washing in naphtha, dry out in sawdust to prevent dirty naphtha from drying on work and leaving a hard-to-remove film. Alkaline clean, and then pickle to remove heavy scale. Warm 10% sulfuric acid, or concentrated hydrochloric acid can be used, preferably with an inhibitor to reduce gassing and excessive attack on the metal.

The pickling will leave a smut of carbon on the metal surface. This must be removed if good coverage, adherence, and appearance of the cadmium deposit is required. Most positive method of removal is sand rolling, wet, with small amount of cyanide. If work cannot be tumbled, immersion in warm 1 lb./gal. sodium cyanide solution will remove light smuts. Heavier smuts require hand scrubbing. Then rinse, clean cyanide dip, and cadmium plate.

If scale and smut removal have been thorough, the work should cover with cadmium after about 10 minutes at the longest. Failure to do this means that the portions of the surface slow to cover, while they may appear to have a satisfactory coating, will in reality have a thin coating through which the iron beneath will corrode and show discoloration.—G.B.H., Jr.

Control of Aluminum Dipping Solutions

October 15, 1942

"Dear Dr. Meyer:

We are interested in finding out if a method has been developed and published by your group or a similar publication covering the testing of acid treating baths for aluminum metal prior to spot welding.

In the vast amount of airplane construction and fabrication of essential parts the practice on the West Coast is to dip aluminum forms in a solution containing approximately 20% commercial nitric acid and 3 to 5% hydrofluoric acid (the remaining 75% is water). It is not particularly difficult to develop laboratory testing methods to determine the strength of the acid components after the bath has been in use for some time, but unfortunately a number of the small parts manufacturers are not equipped with a laboratory or chemically trained personnel. These plants are interested in some practical method, even an empirical method, for determining the strength of acid in the dipping baths. A density (Sp. Gr. or Be.) determination does not give sufficient or reliable information.

We feel that there may be a possibility of finding a practical method in your files. If you know of such a method it would be of great assistance to us and the aviation industry as a whole. We have in mind the possibility of some type of strip test which would show the effectiveness of the bath plotted against a time factor for the test.

Any assistance or recommendation that you can offer will be greatly appreciated.

G. C. Co."

Has anyone something to suggest?—Ed.

Patents

Bright Zinc Bath

U. S. Pat. 2,288,318. R. A. Hoffman, assignor to E. I. duPont de Nemours & Co., June 30, 1942. A cyanide zinc bath containing an addition agent prepared by reacting materials consisting of a phenol-aldehyde condensation product and a soluble compound of a metal of the group consisting of molybdenum, chromium, manganese, nickel, iron, titanium, rhenium, aluminum and tungsten. The phenol is from the group consisting of catechol, cresol, hydroxydiphenyl, naphthol and phenol. The aldehyde is from the group consisting of acetaldehyde, acetal, butyraldehyde, crotonaldehyde, formaldehyde, furfural, paraldehyde and propionaldehyde.

Bright Copper Bath

U. S. Pat. 2,287,654. C. J. Wernlund and R. R. Bair, assignors to E. I. duPont de Nemours & Co., June 23, 1942. A cyanide copper bath containing at least 1 oz./gal. of sodium hydroxide, from one to eight oz./gal. of an alkali metal sulfocyanide and a small amount of a soluble carbohydrate, operated at not less than 60°C.

Example 1:

Copper cyanide	16 oz./gal.
Sodium cyanide	16 "
Caustic soda	4 "
Sodium sulfocyanide	2 "
Starch	4 g./gal.
Temp.	= 60°-78°C.
C.D.	= 10-40 amp./sq. ft.

The salts are dissolved in two-thirds the required amount of water and the solution heated to 95°-100°C. The starch is then added as a slurry in cold water. The solution is kept at 95°C. for 15 minutes and allowed to cool.

Example 2:

Copper cyanide	16.5 oz./gal.
Sodium cyanide	16 "
Caustic soda	4 "
Potassium sulfocyanide	2 "
Cane sugar	4 g./gal.
Temp.	= 80°C.
C.D.	= 32 amp./sq. ft.

Descaling Copper & Alloys

U. S. Pat. 2,291,201. W. H. Bassett, Jr., and C. J. Snyder and W. G. MacLelland, assignors to Anaconda Wire and Cable Corp., July 28, 1942. The method of removing scale from cupreous articles which comprises exposing the article to copper chloride vapors, treating under conditions causing chemical reaction to occur between the scale thereon and the copper chloride, heating the article to a dull red heat to convert the scale to a form which separates readily from the article upon cooling thereof and cooling the heated article whereby the scale is caused to separate substantially completely from the article.

Abrasion and Corrosion Prevention

U. S. Pat. 2,298,079. G. L. Adams and R. A. Baker, assignors to Socony Vacuum Oil Co., October 6, 1942. The method of protecting metal surfaces exposed to corrosion by acid or sulfurous vapors, to abrasion by impinging particles, and to heat which consists in applying to said metal a coating formed of approximately 100 parts litharge and 27.5 parts glycerine and embedding grains of abrasion-resisting solids in the exposed surface of said coating.

Descaling Copper & Alloys

U. S. Pat. 2,291,202. W. H. Bassett, Jr. and C. J. Snyder and W. G. MacLelland, assignors to Anaconda Wire and Cable Corp., July 28, 1942. The method of removing scale from cupreous articles which comprises treating the article with an aqueous solution containing chloride ions and sulphate ions, heating the so-treated article to a dull red heat, and quenching the heated article.

Example:

Sodium chloride	5%
Copper sulfate	10%

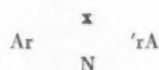
Immerse in this solution for a few minutes. Heat for about 30 minutes at 1200°-1250° F. and quench.

Metallizing Glass

U. S. Pat. 2,292,026. H. W. Gillett, assignor to Battelle Memorial Institute, August 4, 1942. An article of manufacture comprising glass coated with zirconium and titanium. An adherent film of the metal is produced by rubbing a rod of the massive metal over the glass surface. It is claimed that other metals may be deposited over these films.

Bright Nickel

U. S. Pat. 2,291,590. R. Lind, W. J. Harshaw and K. E. Long, assignors to The Harshaw Chemical Co., July 28, 1942. Addition agents for the production of bright and ductile nickel deposits, one selected from the class of compounds containing the group-



where x is selected from the group consisting of N, C, S & O, and which are soluble in the bath to the extent of at least 1 mg./l. and mixtures of such compounds, and the other of said addition agents being selected from the class consisting of naphthalene sulfonates, the single ring aryl sulfonamides and the single ring aryl sulfimides and mixtures thereof present in the solution in the bath to the extent of at least 0.2 g./l.

Example:

Nickel sulfate	240 g./l.
Nickel chloride	37.5 g./l.
Boric acid	37.5 g./l.
Nigrosine (Schultz No. 986)	100 mg./l.
Sulfonated naphthalene	20 cc./l.
Sodium lauryl sulfate	0.25 g./l.
pH = 3.0	Temp. = 60° C.
C.D.	= 50 amps./sq. ft.

A list of suitable addition agents is given in the patent.

Plating Stainless Steel Wire

U. S. Pat. 2,293,810. E. C. Dorn, assignor to National-Standard Co., August 25, 1942. In the continuous plating of stainless steel wire, the steps of passing a chromium containing stainless steel wire continuously through a bath of dilute sulfuric acid while maintaining the wire as the anode, then passing it through a bath of sulfuric acid as cathode and then passing the wire into a cyanide copper plating solution through a fabric wetted with sodium carbonate solution to prevent access of air to the wire.

Example:

1. Treat anodically in 10% sulfuric acid at room temperature for 1 minute at 75 amp./sq. ft.
2. Immerse in 10% hydrochloric acid at room temperature for 20 seconds.
3. Rinse and treat cathodically in 10% sulfuric acid at room temperature for 30 seconds at 30 amp./sq. ft.
4. Pass into cyanide copper bath through cloth wetted with 8 oz./gal. of sodium carbonate crystals at 120° F.

The copper solution may be composed of:

Metallic copper	35 g./l.
Free cyanide	25 "
Sodium carbonate	10 "
Hypo	5 "
Operate warm and at 30 amp./sq. ft.	

Metallizing Glass

U. S. Pat. 2,293,822. C. D. Haven, assignor to Libbey-Owens-Ford Glass Co., August 25, 1942. An adherent coating is formed on glass by metal spraying an alloy of approximately 1/2 to 4.5% titanium and the balance copper (1.5-2.5% titanium preferably). The film is claimed to withstand scraping with a sharp blade.

Electropolishing Iron

U. S. Pat. 2,294,227. R. P. Delaplace and C. L. Bechard (France), assignors to Soc. Brevets Aero-Mecaniques S. A. (Switzerland), August 25, 1942. A method of anodic polishing of a steel body using a solution of pyrophosphoric acid in non-aqueous solvent such as alcohol.

Example:

Pyrophosphoric acid	400 g.
Ethyl alcohol	To make 1 liter
Temp.	= 20° C. Time = 10 min.
C.D.	= 30 amp./sq. dm.

Rinse quickly in acid solution such as phosphoric acid to dissolve traces of ferric pyrophosphate. Use an aluminum container or other heat conducting metal as cathode.

Corrosion Prevention of Aluminum

U. S. Pat. 2,294,334. W. F. Filbert, assignor to E. I. duPont de Nemours & Co., August 25, 1942. The method of coating aluminum which comprises treating with a hot solution of an alkali carbonate and a soluble chromate and subsequently exposing the treated surface to the action of steam at super atmospheric pressure (50-150 lb.).

Example: Immerse for 30 min. at boiling in:

Sodium carbonate	24 g./l.
Sodium dichromate	4 "

Rinse and place in autoclave for 1 hour in a steam atmosphere at approximately 95 lb. pressure. Then remove and dry.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Protective Coating

Protective Coatings, Inc., Box 56, Strathmoor Sta., Detroit, Mich., announce another new product in their "Alkacite, Type AA", a glossy, black liquid coating.

This material may be applied by brush or spray and dries rapidly. One coat is recommended as a galvanizing substitute for exposed surfaces and two or more coats, for liquid contact.

"Alkacite, Type AA" is advised as a lining for tanks, vats and other vessels where abrasion is not present and for acid tanks in which acid brick facing is installed. It is said to offer good resistance to both acids and alkalis. However, it is not to be used in contact with oils, greases, or solvents.

Alkaline Metal Cleaner

The Philadelphia Quartz Company, 121 South Third Street, Philadelphia Pa., have announced a new formula for cleaning of light steel.

The formula recommended is a 1 per cent solution composed of 19 parts sodium metasilicate and 1 part of an alkyl aryl silicate or wetting agent. The latter material is designed to reduce surface tension and to assist the metasilicate solution in the removal of the grease film, which is usually accomplished within a few seconds. This, and other applications of sodium metasilicate with synthetic wetting agents involving aluminum cleaning are reviewed in the September issue of "Silicate P's & Q's". Copies are available on request to the Philadelphia Quartz Company, Philadelphia.

Flux for Gas Welding Aluminum

A new, free-flowing flux for the gas welding of aluminum and aluminum alloys is now being manufactured under the trade-name of "Flo-Ez-Flux" by Park Stewart, 1044 Carbis St., Worthington, Pa. The manufacturer claims that as a result of improved methods of manufacture, the flux will not solidify or deteriorate.

The flux is being used to gas weld either wrought, cast or high tensile aluminum or aluminum alloys, of any size or shape where welding is possible. It is being widely employed in the aviation industry.

Flo-Ez-Flux is packaged in a glass container, which prevents corrosion and protects the flux from moisture, and is available in a large number of sizes ranging from ¼ lb. to 25 lb.

The manufacturer will furnish complete information on request.

Adhesive for Polishing Wheels

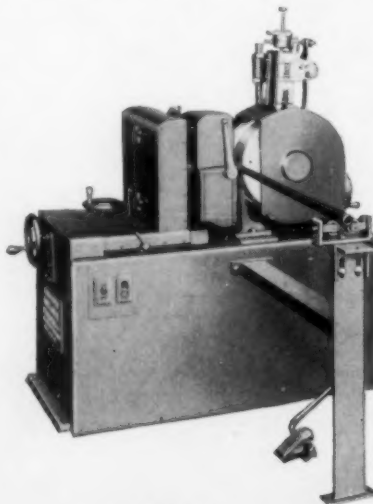
The Hanson-Van Winkle-Munning Co., Matawan, N. J., has developed a new type of adhesive to be used as a substitute for glue in facing polishing wheels. This material is called "H-VW-M Adhesive".

Instructions for Use: H-VW-M Adhesive is used the same as glue. Since it is ready to use, it is not necessary to weigh out ingredients or to dissolve and cook beforehand. Simply heat it and proceed to use it as soon as warm. Do not heat over 150° F. The consistency of the material itself is suitable for coarse abrasives such as No. 60 grain. For finer grain sizes, add water at any time to dilute. For No. 180 grain, add up to 25 per cent of the weight used. For intermediate grain sizes between Nos. 60 and 180, add water in proportion as needed. Unused material may be reheated without waste. Keep in a cool, dry place.

"OD" Cylindrical Polishing Machine

An outside diameter cylindrical finishing machine with a wide variety of applications in the production of war materials is now being built by Hammond Machinery Builders, Inc., 1601 Douglas Avenue, Kalamazoo, Mich.

The machine illustrated shows one of the many ways in which it can be arranged, using a special wheel with "Auto-Doper" adapted to the particular work for the polishing member. The machine may also be arranged with backstand idler pulley and



Cylindrical polishing machine.

patented segment face contact wheel to permit the use of surface-coated abrasive belts which run over the face of the wheel and to the backstand. This allows polishing and finishing on many materials and shapes of articles previously beyond the scope of this type of apparatus. Already in use in the production lines on such parts as bombs, universal joints, condenser tubing, shell cases, gun barrels (as illustrated), steel tubing, brass magazines, etc., the machine handles parts from ¼" to 9" outside diameters.

The new method of utilizing surface-coated abrasive belts instead of set-up polishing wheels is said to effect striking savings as well as increase production rates.

The machine is designed with a range of feed of 0 to 50' per minute for 1" diameter, forward or reverse and thus permits inexperienced operators to secure quality finishes at high production rates. A quick release lever enables the operator to control the

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Metal Finishing Consultant
War plating plants designed and streamlined for increased production.
LA 4-9794 233 W. 26th St.
New York City

work being fed through the machine by disengaging the work from the face of the wheel. The work support is adjustable easily to the wheel for work of varying diameters. This support is either Hammond's standard or a specially built one for the customer's particular requirements having features such as special ball bearing fixtures, guides, etc. All parts of the "OD" machine are carefully guarded and readily accessible and the guard cover can be quickly removed for changing wheels and abrasive belts.

More complete information will be furnished by the company upon request.

Oil Absorbent Compound

Trojan Products & Manufacturing Company has developed a new, oil absorbent compound called "Quik-Sil."

This material is easily applied around dripping motors and machines and is especially recommended as a safety device to eliminate the slip hazard for aisles and floors which are apt to become oily.

"Quik-Sil" is stated to be entirely fire-proof, odorless, dustless and re-usable.

For additional information or for a free demonstration at your plant, address "Service Department," Trojan Products & Manufacturing Company, 3130-C South Wabash Avenue, Chicago, Ill.

Polar Type Rust Preventive

Announcement is made by The Curran Corporation, Malden, Mass., of a light "Polar K" oil which is claimed to have the properties of completely removing perspiration, water, oil and dirt from steel surfaces.

The new oil is said to be superior to alcohol for dehydrating and cleaning steel surfaces, bearings or similar parts which have become wet or have been left with a film of grinding emulsion.

The new oil is claimed to instantly displace water and leaves a thin film of polar type lubricant and rust preventive. The new oil is said to be especially applicable for protecting during storage the water side of steam turbines, water pumps, meters and steel parts which may have been exposed to rain, immersion in sea water or damp storage.

The fluid has also been found useful for spraying the inside of Diesel and gasoline engine cylinder walls which have accumulated a film of condensed moisture as a result of storage in damp atmosphere. Its use for flushing crankcases to remove sludge, moisture and acid salts is being expanded.

The oil is completely soluble in hydrocarbons and lubricating oils and no subsequent cleaning procedure is necessary to remove the thin, film protective, rust preventive lubricant.

The fluid neutralizes the salty acid touch of fingers. Strangely enough, according to A. F. Curran, Research Director, the presence of salt or perspiration (ordinarily causing rust under oil) increases the rust preventive characteristics of the thin film deposit left by the fluid.

For further particulars, write Chemical Development Laboratory, Curran Corporation, 6 Pleasant Street, Malden, Mass.

Speed ACID PICKLING the DOUBLY SURE* Way with Enthone Acid Addition Agent



★ **FASTER PICKLING** — the acid rapidly penetrates under rust and scale, thus **LIFTING THEM OFF!**

★ **SAVES ACID** — Drag-out is materially reduced and acid is saved by inhibiting action.

OVERCOMES WATER-BREAK IN PICKLING — Due to poor alkaline cleaning or soap in the alkaline cleaner, water-breaks appear on acid dipping before plating. The use of **ENTHONE AAA** in the acid literally makes the acid a cleaner and overcomes peeling due to faulty cleaning.

Write today for **FREE Trial SAMPLE** and valuable informative **BULLETIN**

THE **Enthone** COMPANY
NEW HAVEN CONNECTICUT

McKeon's

"Liquid Sulphur"
TRADE MARK 1937

STRIPS COPPER PLATING

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SELECTIVE CARBURIZING

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(Service? Sure.)

INVESTIGATE

OUR SPECIAL DEGREASING COMPOUNDS AND CLEANERS

1. For cleaning brass and steel cartridge cases, all sizes, after drawing and machining.
2. For cleaning H. E. and A. P. projectiles, all sizes, after machining, and prior to lacquering and painting.
3. For process cleaning of airplane motor parts (aluminum and magnesium).
4. For cleaning sheet aluminum prior to spot welding and for cleaning sheet and cast aluminum prior to anodizing.
5. For cleaning fuses and fuse bodies (aluminum or brass) after machining.
6. For cleaning steel fuse parts and boosters prior to cadmium plating.
7. For cleaning bomb fins, fin assemblies, and similar steel stampings prior to painting and lacquering.
8. For cleaning prior to cadmium and hard chrome.
9. For cleaning prior to all blackening and blueing operations and after magnaflux.
10. For cleaning prior to Bonderizing and Parco-Lubrizing operations.
11. For use in water-wash spray booths.
12. For burnishing and stripping.

There is a Wyandotte specialized cleaner for every metal cleaning problem and for use in all types of equipment.



THE J. B. FORD SALES COMPANY

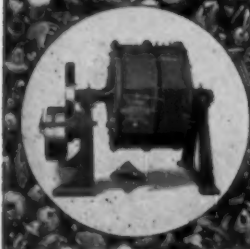
WYANDOTTE, MICHIGAN

Cutting Corners ... for Top Speed Production

Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.

Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.

The Abbott Ball Company
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Plating Rack Insulation

Synthetex, Type 50, is a new insulation material designed for plating racks, tank linings and electrical units by Protective Coatings, Inc., Box 56, Strathmoor Sta., Detroit, Mich.

A water-clear coating for use on all metals and applied by dipping, brushing or spraying, Synthetex, Type 50, is recommended for all plating solutions including commercial and hard chromium types.

Tank Lining

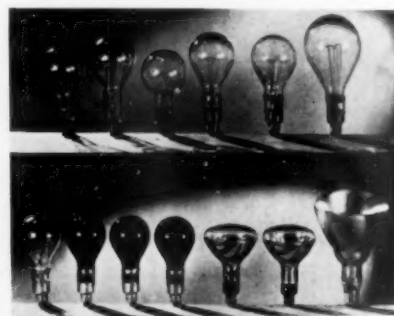
Alkacite, Type HM-A1 is a recent development of Protective Coatings, Inc., Box 56, Strathmoor Sta., Detroit, Mich.

Developed primarily for tank linings, this product is said to resist oxidizing agents, caustics and strong acids such as nitric and hydrofluoric acid, at elevated temperatures.

It is applied in a seamless fashion. Gauges may be varied with requirements, $\frac{1}{4}$ " to $\frac{3}{4}$ ".

New Infra-Red Heat Lamps

A complete new line of infra-red heat lamps, designed in keeping with the limitations imposed by the War Production Board, has just been announced by the Birdseye Division of the Wabash Appliance Corporation, 335 Carroll Street, Brooklyn, N. Y. The new line includes six clear types, three ruby types and four reflector types. All feature the M-type tungsten filament for uniform heat distribution and have their bases reinforced with asbestos-lined me-



Infra-red heat lamps.

chanical straps to withstand the high temperatures of tunnel installations. The reflector types have built-in reflector linings of pure silver sealed inside the bulbs for protection against dimming and tarnishing by fumes or dirt. Average burning life on all is in excess of 6,000 hours.

The advantages of the use of infra-red lamps for baking, drying and dehydrating are discussed in new literature available from the Wabash Appliance Corporation.

Protective Clothing

A new type of protective clothing known as "Ply Garb" is announced by the Milburn Company, 905 Henry Street, Detroit, Mich. In both design and material, Ply Garb sleeves and aprons are said to be an innovation that provides an exclusive combination of advantages for workers exposed to water, acid, fire, alkalis and chemicals of all kinds.



Workman using new clothing.

Ply Garb was designed to supplement the use of Ply creams and liquids in operations where the exposed skin is subject to abrasive action or where the protection of clothing is of importance. The material is flame-proof, thus preventing serious injury from spontaneous magnesium fires and other hazardous manufacturing operations.

Made of featherweight, but extremely tough plastic laminated cotton cloth, the sleeves and aprons offer maximum comfort and freedom of movement. The sleeves feature special air vents to guard against excessive perspiration. Adjustable shoulder straps make it easy to fit the aprons to the individual. The aprons are available in both full-front and split-front models. In the latter, the garment may be fastened around the thighs and legs in a manner similar to cowboy chaps. The fabric is sturdy enough to resist tears, snags on rough surfaces and cracking. It is flexible enough, however, to resist wear and afford complete comfort.

Ply Garb aprons and sleeves are made for both men and women, with each detail of design and manufacture complying with the recommended specifications of the United States Department of Public Health for the most protective clothing.

Rust Inhibiting Wax Coating

S. C. Johnson & Son, Inc., Racine, Wisconsin, have announced the development of special "rust inhibiting" wax emulsions that are recommended for use in applying protective wax coatings to metal surfaces. The coatings are recommended particularly for phosphate treated surfaces and black oxide coatings on steel.

The waxes are stated to harden quickly upon application and to dry to a hard film which does not show finger marks or collect dirt. According to the vendor, the waxes are non-inflammable, fast-drying and can be easily applied by dipping or spraying.

The dipping procedure is conventional. Small parts are placed in a wire basket and immersed in the wax tank, followed by centrifuging. Larger pieces are dipped individually or in racks, then air dried or force dried.



Sylphon Control saves HEAT, SPOILAGE, LABOR

for Standard Plating Works



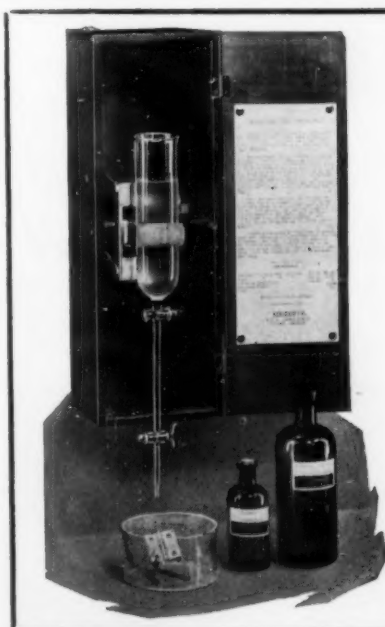
At the Standard Plating Works, San Francisco, California, Sylphon Control not only maintains bright nickel plating temperatures at the desired degree for most effective results —i.e., best plating at lowest steam consumption—but labor and supervision are reduced to the point where "the control is set by the workman who walks away and practically forgets it" until time for removal of plated products.

The company reports: "The dependability and trouble-free operation of these Controls, that respond quickly and hold correct temperatures within close limits, effect a saving in heat, materials and manufacturing costs."

Write for Bulletin VA-20.

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE

Representatives in All Principal Cities in U.S.A. and in Montreal, Canada and London, England



ZINC SOLUTIONS & DEPOSITS

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If your job needs a special-type solvent, investigate Cowles LIXOL, emulsion-type solvent cleaner. You can use LIXOL on all metals—steel, iron, brass, copper, bronze, aluminum, die castings—for safe, speedy degreasing and cleaning.

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SPECIALISTS ..that's what we are

WE DESIGN, Engineer and Build the most-talked about, dependable, practical

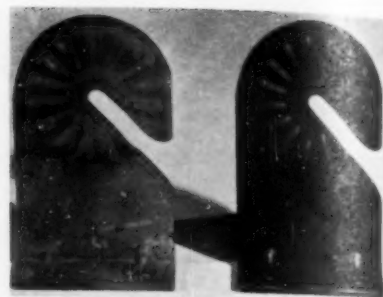
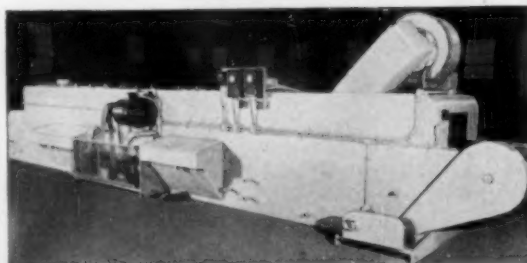
RANSOHOFF LABOR-SAVING EQUIPMENT FOR THE SURFACE TREATMENT OF METALS

Submit your problem . . . let the RANSOHOFF ENGINEERS suggest the right type of equipment for washing . . . rinsing . . . drying . . . parkerizing . . . rustproofing . . . burnishing . . . sawdust-polishing

Ransohoff conveyor type machine for washing, rinsing and drying airplane motor parts.

N. RANSOHOFF, Inc.

Metal Cleaning Specialists
Township & Big 4 R.R.
CINCINNATI, OHIO



Both samples above were Parkerized and subjected to 24 hr. salt spray. Sample on left was unwaxed and sample on right was waxed.

To apply the wax coatings by the spray method, any standard spray equipment may be used. The spray gun should be fitted with a high capacity air cap and low capacity fluid tip. Air pressure should be about 45 to 50 lb. at the nozzle. Adjust fluid control so as to allow a minimum to enter the gun. The wax should be applied by making several passes back and forth across the spray pattern to insure a thin, even coat. Too heavy a coat can cause sag or runs.

Several types of clear and black wax emulsions are available to fit special purposes.

Manufacturers' Literature

Brushes for Metal Products

Hanson-Van Winkle-Munning Co., Matawan, N. J., have issued a new edition of their Bulletin Br-103 on brushes. This bulletin includes a new section on the "Staplbond" tampico brushes and steel wire brushes which embody a newly developed type of construction. Other brushes described in this bulletin are steel wire sections, steel wire fillers, circular brass and steel wire scratch brushes, Tampico, bristle, goblet brushes, brushes for glue and sawdust, satin finishing, plater's scouring brushes, cotton potash brushes, lacquer brushes, circular cotton wick brushes, spiral wire ring brushes, watch case and end brushes.

Degreasing Machines

Degreasing Machines—A 24-page, two-color catalog on solvent degreasing equipment has just been issued by the Detroit Rex Products Company, 13005 Hillview Avenue, Detroit, Michigan. Information is presented in an interesting and easily understood style on all phases of this metal cleaning method. The catalog contains numerous illustrations of various types of degreasers, and data on solvents. Detrex degreasers of vapor, immersion, spray, and vapor-spray-vapor types are featured. Interesting adaptations of various kinds of conveyors installed in the company's degreasers are described in detail. One portion of the book presents degreasers of special design and construction for cleaning in armament

production, as well as Detrex processing and shot-testing equipment. Alkali, emulsion, and spirits washers, and "Triad" alkali cleaning and stripping compounds are also covered.

Dust Arresters

The Northern Blower Co., 6409 Barberton Avenue, Cleveland, Ohio, have issued an illustrated folder describing their standard and automatic bag-type dust arresters.

Diagrams of the machines are featured as are specifications of the various sizes of each type available.

Metal Parts Washers

A new 24 page book is announced by the Detroit Rex Products Company, 13005 Hillview Avenue, Detroit, Michigan.

The various types of Detrex washers manufactured for use with alkali cleaning compounds, petroleum spirits and emulsion cleaners together with the many features of design and construction incorporated in these machines are pictured and described in detail. Special adaptations of this machinery for defense armament production, particularly in the aircraft industry are included. Four pages of the book are devoted to blue print type of assembly drawings covering in some detail the construction of washers using both belt and monorail conveyors.

Alkali cleaning and stripping compounds, supplied by this company for cleaning of metal parts and used in conjunction with the equipment described above are included. Equipment built for degreasing, shot testing and other processing is also covered.

Copies of the booklet will be sent promptly, without obligation, when requested on company letterhead.

Plating Insulations

The Rackote Division of Wyandotte Paint Products Company, Wyandotte, Michigan, have issued a 10-page booklet on plating insulations. It covers Rackote's complete line of stop-off lacquers, insulations, stop-off strippers and solvents. The booklet also describes the rack coating service maintained by the company and the technical department available to solve plating insulation and masking problems.

A copy of the booklet can be obtained by addressing the Rackote Division.

Polishing Wheels

Advance Polishing Wheels, Inc., 844 W. 9th Place, Chicago, Ill., have issued pamphlet No. 77 to announce their new polishing wheels. Their models of cup wheels, saucer wheels, rolled end buffs, polishing bobs and balancing weights are described and illustrated photographically.

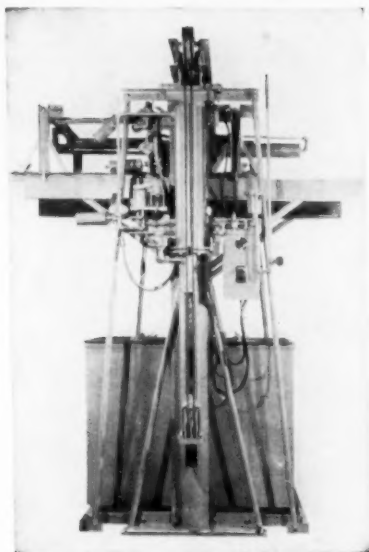
Specifications are also given for the company's electric glue pots, glue brushes and balance ways.

This literature is available upon request from the company.

Processing Carriers

Rolock, Inc., 1200 Kings Highway East, Fairfield, Conn., have issued a four-page circular describing their industrial baskets, crates, trays and fixtures.

Crown Pick-up Unit



...MACHINE...

A UNIT TYPE TRANSFER CAPABLE OF
HANDLING SEVERAL TANKS
AT ONE TIME.

...USE...

FOR A SERIES OF OPERATIONS WHERE THE WORK
MUST PASS THROUGH SEVERAL TANKS, AS
THE CLEANING AND RINSING OPERA-
TIONS, FOR A SEMI-AUTOMATIC
PLATING TANK.

CROWN RHEOSTAT & SUPPLY CO.
1910 MAYPOLE AVENUE CHICAGO, ILLINOIS



BLACK-MAGIC

"Chemical-reaction salt-baths"

Government approved as final finish on small arms and ammunition, also as undercoat or bond for phenolic varnishes and synthetic lacquers. BLACK-MAGIC processes for copper, bronze, zinc, iron and all steels except stainless.

WITCH-DIP a wax base final finish which inhibits rust.

Write for portfolio of complete information.

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BRIDGEPORT, CONN.

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A. R. Purdy Co. Inc., New York City	Clarence Gush, 1218 Olive St., St. Louis, Mo.
Universal Paint & Varnish Co., Cleveland, Ohio	A. J. Walch, 35 E. Wacker Drive, Chicago, Ill.
Henry Steinhaus & Co., Milwaukee, Wis.	Lea Manufacturing Co., Waterbury, Conn.
Knight Research & Mfg. Co., Buffalo, N. Y.	A. J. Hereford, Glenn Bldg., Atlanta, Ga.
Wm. H. Price, Jr. (Divisional Mgr.), 2908 Rising Sun Rd., Ardmore, Pa.	

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99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

BICHROMATE OF SODA
BICHROMATE OF POTASH

Mutual Chemical Co. of America
270 MADISON AVENUE, NEW YORK



Various specialized processing carriers such as those available through this company are illustrated. Among these are an all-welded annealing, quenching and pickling crate for processing 4,000 lb. loads of shell cases; pivoting and quick dumping baskets; a flat wire high nickel alloy brazing tray; a cyanide hardening basket; a projectile carrying rack with a capacity of 30 pieces; a nickel alloy crate for handling 672 lb. loads of shell discs through a spray pickle and a stainless steel self-contained motor driven pickling barrel for smaller sizes of shell cases. Shown also are an anodizing basket for aluminum aircraft rivets; an expanded metal stacking tote box for 500 lb. loads of shell cases; a degreasing basket that rotates through 180°; a pickling basket that works on both rollers and carriers and a stainless steel angle and mesh welded acid strainer.

Protective Coating for Baskets

Michigan Chrome & Chemical Co., 6342 East Jefferson Street, Detroit, Mich., have issued literature describing the use of their stop-off materials for coating baskets used in washing and pickling processes. The use of these stop-off materials is said to obviate the need for the baskets to be made of special alloy steels to resist the various cleaning and pickling solutions.

Selenium Rectifiers

A new bulletin on selenium rectifiers has been prepared and is now ready for distribution by the *Benwood Linze Co.*, 1815 Locust St., St. Louis, Mo.

Covered in the bulletin is general information on selenium rectifiers, including their assembly, plate sizes, efficiency, input voltage, stability, cooling, regulation, etc.

Illustrations, including graphs covered by the text matter, are included in the bulletin.

A copy may be obtained by addressing the company and requesting Bulletin R-40.

Thermocouple Pyrometers

Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia, Pa., have published a revised edition of their "Micromax Thermocouple Pyrometers" catalogue.

In 56 illustrated pages, this book gives information about available instruments—indicators, recorders, and controllers—and about the thermocouples and accessories which are used with them.

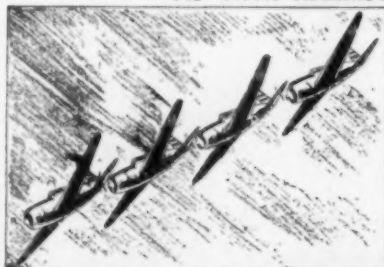
New and prospective users of balance-type (potentiometer) pyrometers will be particularly interested in the description of how the basically-sound balance method is applied to the measurement and control of thermocouple temperatures.

As compared with the 1939 and previous editions, the present book is extensively revised. An automatically-balanced Micromax Indicator and the Model C Controller (non-indicating) for flush mounting have been added. The section on thermocouples has been expanded. And automatic control is outlined more fully than before.

Copies are available from the company at the above address.

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FOR GETTING MORE WORK
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4A CEMENT and THINNER
A Substitute For Glue

NO WORRY ABOUT GLUE SHORTAGE WITH 4A CEMENT AND THINNER. Polishing wheels are free cutting, long lasting and economical when set up with 4A Cement.

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POLISHING COMPOUNDS

4A symbolizes these four features which you require for high speed polishing, mirror finishing of all kinds of steel, including stainless steel, carbon steels and hard-to-buff alloys. Use it on any kind of a wheel, soft, medium or hard.

Tell us your problem and samples of compounds, rouges or cement will be sent. We will be pleased to recommend proper methods.



"AMPLE STOCKS TO TAKE CARE OF OUR TRADE"

HARRISON and COMPANY
Haverhill, Mass.

Tygon

The U. S. Stoneware Co., Akron, Ohio, have recently issued a 16-page bulletin, suitable for loose-leaf insertion, on "Tygon", their synthetic, rubber-like material.

This booklet considers the physical properties of the Tygon series and gives a table showing the relative chemical resistivity of one of them—Tygon "T"—to various acids, alkalis, salt solutions and organic solvents.

Sections are devoted to discussions of Tygon paint, tubing, Tygon strip film for temporary protection and Tygon as used for wire insulation and fabric impregnation.

Rolls, tank linings, coated pipes, lined pipes, cut or molded gaskets, thermocouples, plating hooks and protection for electrical controls are listed as other specific applications of Tygon.

Amplly illustrated and printed in color, this booklet, known as Bulletin No. 1620, is available through the U. S. Stoneware Co. at their New York address, 60 East 42nd Street.

Wet-Dry Belt Surfacing

The Porter-Cable Machine Co., Syracuse, New York, have recently issued a 20-page illustrated booklet describing the method of wet-dry abrasive belt surfacing. It is available upon request from the company.

A four-page summary of the advantages of this procedure over others opens the booklet. Belt surfacing operations on metals are next considered. The remainder of the space is devoted to pictures and specifications of the various types of surfacers manufactured by the company.

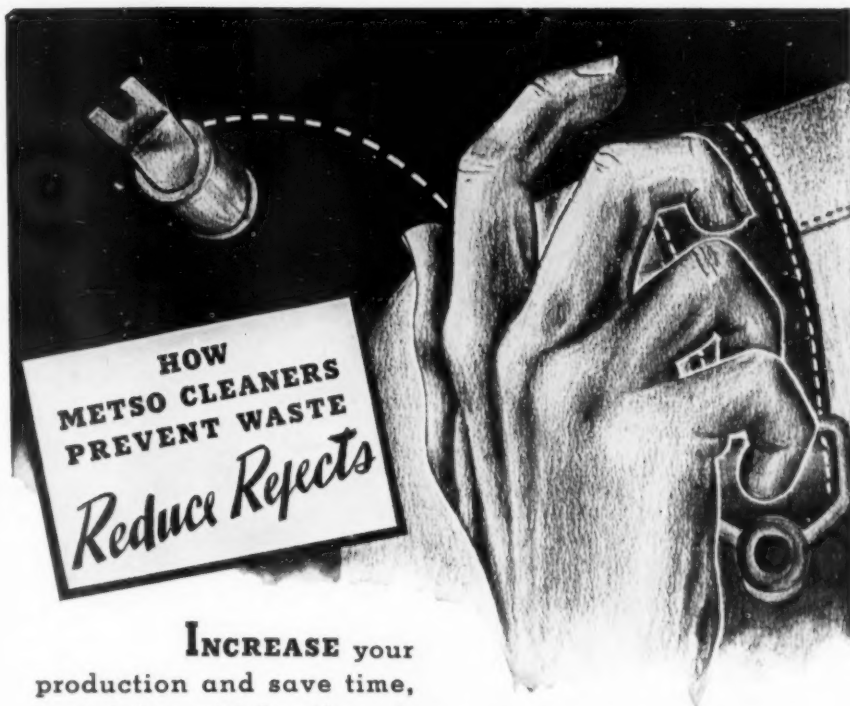
New Books

Chemical Engineering Catalog, 27th Annual Edition. Published by the Reinhold Publishing Corp., 300 West 42nd St., New York, N. Y. August, 1942. Size 8½" x 11¼"; 1336 pages. Distributed free to individuals in the industry provided the catalog is returned to Reinhold Publishing Corporation when the new edition comes out each year. Price for permanent possession is \$3.00.

This bible of the chemical engineering industry presents no radical changes over previous years. The volume is divided into three sections. The first section is devoted to chemicals and raw materials. The second section is devoted to equipments used in chemical engineering work and the third section is devoted to technical books. This last section brings up to date the bibliography of chemical technology.

Some of the features of the book are its trade name index, its classified index of equipments and supplies, its technical data section on engineering equipment, its index giving the source of supply for chemicals, and the aforementioned technical book section.

The book contains a large volume of advertising and in most cases, these are also of value inasmuch as they present technical data on the subject being advertised rather than being institutional type matter.



INCREASE your production and save time, materials, and labor through the use of Metso. Here's how:

Metso cleaning baths quickly loosen oil, grease, buffing compounds, carbon and other dirt. Just as important as dirt removal is preventing its re-attachment to clean metal.

Metso gives this protection because of its properly balanced silica content.

Whether your operations are electro-cleaning, spray-type or soaker tank, you can save with Metso. Ask for prices and more information.

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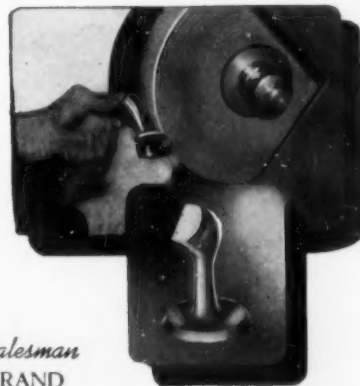
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FELT DOES IT BETTER

What a difference in your finished product when you use *Paramount Felt Polishing Wheels* for grease polishing—that all-important finish that swings the buyer's decision to your product.



Ask your supplies salesman
for PARAMOUNT BRAND

Bacon Felt Co.

WINCHESTER, MASS. ESTABLISHED SINCE 1824

Organic Reagents in Inorganic Analysis. By Paul von Stein. Published by Chemical Publishing Co., Inc., Brooklyn, N. Y. Size 8 3/4" x 5 3/4"; 233 pages. Price \$4.50.

This book is a complete reference work of organic compounds which yield indicative reactions with inorganic materials. Included are the pertinent facts connected with each determination under consideration, as well as reference to the original articles from which the material has been drawn.

Today metallo-organic reagents are of prime importance to the analyst, mainly for three specific reasons. They bring within range, accuracy equivalent to, or greater than, that obtained with inorganic methods; speed surpassing that of inorganic reagents, and ease of manipulation and separation.

The plan used is laid out in the simplest possible form to enable the greatest utilization of the material contained herein. All of the elements dealt with are included in alphabetical sequence, each element composing one chapter, which is further subdivided into paragraphs with the organic reagent under consideration as the sub-title. Every chapter contains as many different reagents as can successfully justify classification under that element. Included with each descriptive paragraph are the necessary references, facilitating a literature search, rather than a lengthy, disturbing bibliography at the conclusion of the book. The attempt has been made to present methods as completely as possible, especially in the

cases where extreme care and accuracy of technique is required, and in the more important procedures which may possibly be coordinated into routine practice.

At the present time there is no treatise covering this subject with as much completeness. Information that is most vital to the analytical research chemist is incorporated in this book.

Tin and Its Uses

The current issue of *Tin and Its Uses* (No. 13) published by the Tin Research Institute, is devoted to emergency economies in tin. It is explained that although in normal times the Institute's purpose is to develop new and improved uses for tin, this would be useless at the present time when a large proportion of the world's tin supplies is under enemy control.

During the period of scarcity the Institute offers its services in the solution of tin economy problems. Accordingly, this issue of *Tin and Its Uses* describes practical methods of saving tin in various fields of use. For example, it is shown that important economies can be effected in joining lead-sheathed cables both by using a solder less rich in tin and by the use of a new type of joint requiring not more than one-third the quantity of solder needed for the traditional wiped joint.

Tin and Its Uses is obtainable free of charge from the Tin Research Institute,

Fraser Road, Greenford, Middlesex, or in the United States from the Battelle Memorial Institute, 505 King Avenue, Columbus, Ohio.

Associations and Societies

Detroit Branch

Annual Meeting

The branch will hold its annual December educational session and banquet on Saturday, December 5th, at the Hotel Statler, Detroit, Mich.

The educational session will start at 2 p. m. with *William M. Phillips*, General Motors Corp., acting as technical chairman. The speakers and the subjects of their talks follow: *Dr. Ralph Lee*, General Motors Corp.—"Human Engineering"; *Lieut. J. Teres*, Army Air Force, in charge of corrosion projects, Wright Field, Dayton, Ohio—"Metal Finishing for Military Aircraft"; *Thomas G. Coyle*, United Chromium, Inc.—"Hard Chromium Plating"; *H. G. Moak*, Chrysler Corp.—"Imagining".

At 7 p. m. the usual banquet and entertainment will be held followed by dancing. The entertainment program will not be as elaborate as in previous years to allow more time for dancing. Tickets for banquet and dance: \$5.00. Admission to educational

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Belke dipping baskets are rigid and sturdy in construction — can be furnished in steel, brass, monel metal or Ni-Chrome in any mesh or size.

Our bakelite baskets "style 4" with removable screen mesh bottoms, are real metal and money savers due to the fact that nothing takes plate, except articles in bottom of basket and does not tend to shade work.



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Is The Nozzle Built To Do The Work

Only a nozzle designed to do a particular job can produce the best results. In our complete line are nozzles which were made to do the following jobs faster and better.

**CLEANING — DEGREASING — RINSING
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Not only do we furnish the right nozzle, but our engineers know spraying and we'll gladly submit their solutions to your problems.

Write us today for the information you need.

SPRAYING SYSTEMS CO.
4039 W. Lake St., Chicago, Ill.

SPECIALISTS IN THE DESIGN AND MANUFACTURE OF SPRAY NOZZLES

session: free to all interested. For further information, address Dr. R. B. Saltonstall, Udylite Corporation, Detroit, Mich.

Philadelphia Branch

The branch will not hold its annual November educational session and dance this year.

Los Angeles Branch

Setting what is believed to be a precedent at the business meetings of Los Angeles AES—attendance at which heretofore had been 100% masculine—was the presence at the October 14 meeting of Miss Evelyn Mueller of the Mueller Brass Co., Los Angeles. Present also was A. E. "Pop" Baker, Mueller Brass Co.'s plating room foreman. The company, which is doing considerable defense work, has just completed installation of a new cadmium tank and some brass solution equipment.

Members of the Los Angeles electroplating fraternity were grieved to learn of the death on Sunday, October 11, of Bert Chapin, aged 72, a long-time employee of Marcus Rynkofs' Liberty Plating Co. in Hollywood. While he was not a member of the A.E.S., Chapin, through 18 years of service in various capacities in the Rynkofs' organization, had made many friends in the industry. There are no survivors, Mr. Chapin usually referring to the Rynkofs and their boys and girls as his "family." Funeral services were held at Los Angeles October 14, with cremation following.

Business Items

Paul Marin of Los Angeles has established himself in business under the name of United Sand Blasters at 3002 Downey Road, Vernon, Calif., just east of the Los Angeles industrial district.

Vernon Julianne has left the Manufacturers' Supply Co., Shelton, Conn., to take charge of all finishing for the International Resistance Corp., Philadelphia, Pa. Mr. Julianne's temporary address is the Y.M.C.A., 5722 Greene Street, Philadelphia.



How to Clean WHAT...AND WHY!

The First COMPLETE Technical Manual on Metal Cleaning

This new Magnus Handbook, now printing, covers the whole story on war time metal cleaning . . . The selection of the most suitable and satisfactory cleaning material, method and machine for each individual metal cleaning problem.

Nowhere else can you find under one cover the comprehensive and practical information at your command in this manual.

You'll need copies for every man in your plant who is concerned in any way with metal finishing operations.

RESERVE THEM NOW!

MAGNUS CHEMICAL COMPANY

Manufacturers of Industrial Cleaning Materials—Washing, Drying, Pickling Equipment—Metal Drazing Lubricants. Also Methods Engineering Service.

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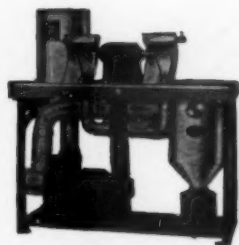
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Tanks, Coloring Rooms, Dynamos, Sawdust Boxes

H. J. ASTLE & CO., INC. Established 1884 (Send for Catalogs) 118 Orange St., Providence, Rhode Island

A. O. Thalacker of Detroit Rex Promoted

The Detroit Rex Products Company, Detroit, Mich., have announced the appointment of A. O. Thalacker as General Manager. Mr. Thalacker has been a company executive for the last five years and lately has been Secretary, a position he retains in addition to his new responsibility.

Mr. Thalacker takes his new position at 35 years of age. Born at Wautoma, Wisconsin,

Jan. 9, 1907, he attended the University of Wisconsin for seven years, graduating with an AB degree as a major in economics in 1931 and from the University Law School with an LLB degree in 1934.

Mr. Thalacker joined the Detroit Rex Products organization in December, 1937 as head of the legal department and in January, 1941 became Secretary of the company. With their three very young sons, he and Mrs. Thalacker reside in Huntington Woods, Michigan.



A. O. Thalacker

California News

By Fred Herr

Pacific Aviation, Inc., has completed installation of a new metal finishing room for hard chromium, anodizing and cadmium work on hydraulic parts and assemblies for airplanes. The shop is equipped with four main processing tanks and 16 auxiliary tank units for rinsing, cleaning and allied work, and three generators. Robert "Bob" Lewis is in charge of Pacific Aviation's plating and polishing department.

Langley Instrument Co. has expanded the facilities of its finishing department with the addition of one anodizing and one general utility tank.

Having just completed a 1000-lot order for silver and brass horns for Army bands, the F. E. Olds Band Instrument Co., Los Angeles, is retooling its plant while await-

ing the go-ahead signal on a contract for air-plane alti-meters. The alti-meter work, according to Joseph Sunderhaus, plating-polishing room foreman, will involve anodizing and copper plating and will be handled in the company's electroplating room where facilities are available for doing gold, silver, nickel, copper, cadmium and chromium work.

With the manufacture of new band instruments for private use materially restricted by priorities, the company is doing considerable work in the repair field on band instruments. This involves chromium plating the slides on trombones, nickel plating valves on cornets and trumpets, and nickel work on trumpet pumps.

The Army, which in the past has used silver horns exclusively, is reported as now using some brass horns for the first time in military bands, which now number some 400.

The H. K. Ferguson Co. has been awarded contracts by the Defense Plant Corp. for construction of the proposed Los Angeles unit of five detinning plants, others of which will be built at Buffalo, N. Y., Birmingham, Ala., New York City and Chicago. Principal sources of supply for the new plants, it is reported, will be a nationwide campaign for used tin cans which is to be started soon.

The C & E Tool & Die Co. has opened for business at 219 East Florence Ave., Los

The PERMAG Process for Cleaning Metals Faster—More Efficiently—Economically

Production on war equipment is mounting daily, and PERMAG is called upon for highly important metal cleaning jobs. Where unusual jobs—new problems have arisen, PERMAG Compounds are required to find the solution.

If you have any difficulties in cleaning metal at your plant, write or phone us. Our years of experience are at your service.

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Representatives, also
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Sheets—Rolls

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WATERBURY ROLLING MILLS, Inc.

Waterbury, Conn.

WORLD'S FINEST PRE-FINISHED METALS • SHEETS & COILS

NICKEL, CHROMIUM, BRASS AND COPPER FINISHES

AMERICAN NICKELOID COMPANY

8 SECOND ST. PERU, ILLINOIS

For a real good polishing job use

KEYSTONE EMERY

Write for Sample

KEYSTONE EMERY MILLS, 4318 Paul St., Phila., Pa.

Angeles. Heads of the firm are R. F. Collins and Charles G. Klingler.

North American Aviation Co. has installed a new cadmium and hard chromium tank and a total of four new processing tanks with auxiliary equipment in the plating room of its Calif. plane factory, where George Corbrouge superintends the electroplating and polishing activities.

Harold Shepard, plating room foreman for seven years at the Repcal Manufacturing Co., has been appointed foreman of the electroplating department of Norris Stamping & Manufacturing Co., Los Angeles. The company, which is engaged in mass defense work, operates three shifts in metal finishing work, over which Shepard presides as general foreman.

Clarence E. Thornton, manager, Los Angeles branch, Chas. F. L'Hommedieu & Sons Co., left October 10 for a three weeks business and pleasure trip to the middle-west. Accompanied by Mrs. Thornton, he planned to call at the Chicago home office of his firm and then visit relatives in Muncie, Ind. E. W. Wells, Thornton's assistant, who recently returned from a trip to Chicago and Detroit, carried on at Los Angeles during Thornton's absence.

Menasco Manufacturing Co. has augmented the equipment in its plating and polishing room with eight new processing

tanks, including three for hard chromium work and others for copper, cadmium and anodizing. Miscellaneous cleaning and rinsing tanks to complement the main tanks, and five generators, have also been installed in the company's 30 by 100 foot modern plating room. James Huston is the plating and polishing foreman.

Universal Cast Iron Fittings Co. has been opened at 2268 East 15th St., Los Angeles, by A. W. Klaschjo and Charles M. Silver.

Paul O'Cello of Los Angeles has established the Production Grinding Co. at 7406 Avalon Bldg., Los Angeles.

F. M. Hoeffler, vice-president and general manager of Harvill Aircraft Die Casting Corp., Los Angeles, has been elected president, and Warren Stratton, company counsel, has been named to the board of directors. Hoeffler, who succeeded H. L. Harvill, who retired in July, was formerly affiliated with Douglas Aircraft Co., and Vultee Aircraft, Inc.

Walter Bradley, California State mineralogist, reported that about 600 tons of tin ore have been extracted from the Evening Star, the first shipment having consisted of cassiterite, tin oxide. Bradley declared that three laboratory tests of the shipment, made in New York and Chicago, were said to have averaged 6.21 per cent metallic tin.

Harold P. Wade has been appointed general manager of Adel Precision Products Co., North Hollywood, Calif.

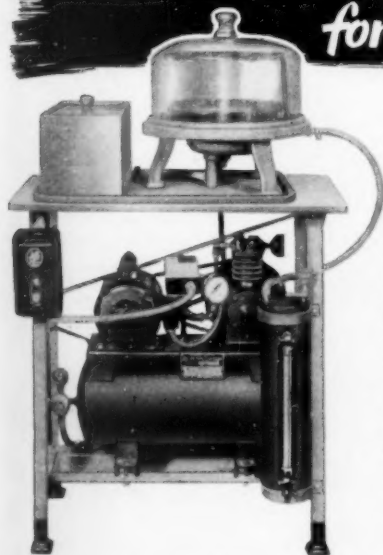
Representing the first commercial shipment of tin produced in the United States since outbreak of the war, a 25-ton shipment moved early in October from the Evening Star mine to the Tin Processing Corp. plant at Texas City, Tex., where the government is smelting tin ore from Bolivia.

A. E. Sulzinger, formerly plating room foreman for Bert A. Landers, Inc., Los Angeles display fixture manufacturers, has transferred to the Hughes Aircraft Co. as foreman of the plating department. Anodizing, cadmium work and tin plating constitute a large part of the shop's activity, largely on pilot seats for training planes produced by the Vultee Aircraft Co.

A new process of steel fabrication by which reinforcing bars of "expanded" metal are welded to paper thin steel sheets has been developed by Vultee Aircraft Co.

The new method of manufacture, developed by Vultee engineers because of the difficulty of spot welding aluminum, will be used in making trainer planes, it was announced. The process is expected to release considerable amounts of aluminum for bombers and fighting planes as it will permit an exterior finish without the aerodynamic drag of rivet heads.

BELKE BELL JAR SALT SPRAY TESTER for small parts



Belke Bell Jar Salt Spray Testing Machine is found in standard equipment in all efficient plating plants. Is compact, easy to operate and moderately priced. Glass Cover 7" high x 13" in diameter enables operator to observe machine in operation at all times. Is equipped with automatic switch and pressure regulation at compressor to insure steady uniform spray and economical operation. Has humidifier for cleaning and dampening air to eliminate crystallization of salt on nozzles. Gauges are conveniently located. Is just as effective as large cabinet style salt spray testers with exception of capacity which is smaller and more economically produced. Rubber lined. Comes fully equipped and ready to operate. Simply attach to any light current and start your test. (Be sure and specify electrical requirements.)

Price complete as illustrated above with tank for continuous replenishment of solution \$210.00

Price with Bell Jar, Compressor and Table only \$175.00

Belke also manufactures cabinet style salt spray machines for larger work — prices and details can be supplied on request.

BELKE MANUFACTURING COMPANY
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BUFFS, CLEANERS BUFFING COMPOSITIONS—NICKEL ANODES CHEMICALS AND GENERAL SUPPLIES

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RIBBON ZINC

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CHROMIUM PLATING SCREWS—RIVETS—WASHERS SMALL PARTS, ETC.

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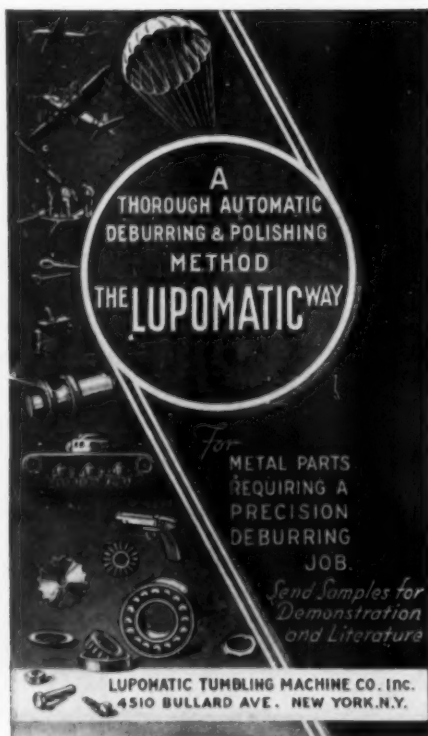
Truly—Three Great Finishes!!

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A THOROUGH AUTOMATIC
DEBURRING & POLISHING
METHOD
THE LUPOMATIC WAY

For
METAL PARTS
REQUIRING A
PRECISION
DEBURRING
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Send Samples for
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HARD CHROMIUM
USE
ZIALITE
ADDITION AGENTS

to obtain

1. Finer grain structure
2. More durable plate
3. Smoother heavy plate
4. Greater throwing power
5. Less sensitivity to sulphate ratio.

Send a sample of your present bath to see if it is suitable for conversion to this improved formula.

ZIALITE CORPORATION
143 Exchange Street
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INSULATED PLATING RACKS

Special and Standard Sizes

For all parts regardless of shape. We specialize in your rack problem.

STANDARD PLATING RACK CO.
1925 N. Paulina St.
Chicago, Ill.
ARMITAGE 6706

Coulter-Sibbett & Burke Co. has completed a new forging plant at its main factory, 6101 Wilmington Ave., in the Los Angeles Central Manufacturing District.

Papers of incorporation have been received by Herbert Lindsay authorizing him to establish the Hy-lo Unit Metal Products Co., 961 Fair Oaks Ave., Pasadena, Calif.

The Los Angeles Magnesium Casting Co. has moved from 5531 South Riverside Drive, Maywood, Calif., to a modern new plant at 6531 Riverside Drive in the same city.

Robert W. Renton has become affiliated with The Lea Manufacturing Company of Waterbury, Conn., to work as Field Consultant in the furtherance of the use of "Lea Compound" and allied products for burring and polishing in the war industries.

Mr. Renton has represented The J. B. Ford Sales Company for several years in the Ohio area and his efforts in his new connection will be in the Middle West, chiefly in the state of Ohio.

Dr. Joseph Robitschek has been engaged by The United States Stoneware Company to take charge of their ceramic research program. He will make his headquarters at Tallmadge, Ohio.

Dr. Robitschek has had many years of experience in the production of chemical stoneware and refractory materials in the leading ceramic manufacturing plants in Czechoslovakia, Belgium, France and Germany. Ceramic engineers will recall his many outstanding contributions to European technical journals.

A. F. Tengwald, 1024 S. Citrus Avenue, Los Angeles, Calif., has been assigned the Southwest territory and Salt Lake City for James H. Rhodes & Company. He is replacing the late Mr. Clement, who passed away several months ago, and expects to contact Mr. Clement's old customers.

Heil & Company, 12901 Elmwood Avenue, Cleveland, Ohio, manufacturers of chemical resisting equipment, have changed their name to Heil Engineering Company.

Announcement is made of the removal on October 1st of the Cambridge Plating Co., Inc., to larger quarters at 84 Prospect Street, Cambridge, Mass.

E. Reed Burns Manufacturing Corp. whose office is at 40-42 Withers Street, Brooklyn, with plants in Brooklyn, N. Y. and Lincoln, N. J., announces the appointment of Courtney & Co., Dallas, Texas, as exclusive representatives for their line of buffs and polishing compounds.

Courtney & Co. are well known in the Southwestern territory as a manufacturer's representative for twenty years, and will cover the following states: Texas, Oklahoma, Arkansas, Louisiana, New Mexico and Colorado.

**VULCAN
SODIUM
STANNATE**

Manufactured by

THE VULCAN DETINNING CO.
SEWAREN, N. J.

Under Patents Nos. 1,575,217 and 1,708,392

**FOR TIN
ELECTROPLATING**

SALES AGENT

The R. & H. Chemicals Dep't, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.



Made from the highest quality selected ores obtainable in this country and in the same careful and thorough manner as imported emeries.

These rough-surfaced solid shaped grains hold unusually well in the glue.

Write for full details.

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Bronze and Gilding

Processed For
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